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JOURNAL

OF THE

Bombay Natural History Society.

FURTHER LIZARDS AND SNAKES FROM PERSIA AND MESOPOTAMIA.

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Chin Shields of *Phyllodactylus elisoe*, Werner.

This figure was omitted from Vol. XXVIII No. 1 of the Journal and should be included with Miss Procter's paper on 'Further Lizards and Snakes from Persia and Mesopotamia to face page 251.'

XXIV., p. 78 (1915).

Perdix hodgsonii.—Adams, P.Z.S., 1858, p. 503 (N. of Mussoorie); Jerdon, B. of I., III., p. 575 (1863).

Perdix (Sæfa) hodgsoniæ.—Gray, Hand-L., B. II., p. 267 (1870).

Perdix hodgsoniæ hodgsoniæ.—Hartert, Vög., Pal., III., p. 1936, (1921).

Vernacular Names.—*Sakpa* (East Tibetan); *Rhakpa* (Central Tibet); *Che-Tra* (Kongbo Tibetan) (F. M. Bailey).

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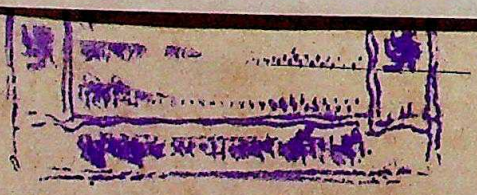

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JOURNAL

OF THE

Bombay Natural History Society.

JUNE 1922. VOL. XXVIII. No. 3.

THE GAME BIRDS OF INDIA, BURMA AND CEYLON.

BY

E. C. STUART BAKER, F.L.S., F.Z.S., M.B.O.U., C.F.A.O.U.

PART XXXII.

(*Continued from page* 312 *of this Volume.*)

(*With a plate*).

PERDIX HODGSONIÆ HODGSONIÆ

The Tibetan Partridge.

Sæfa hodgsoniæ.—Hodg., J.A.S.B., XXV., p. 165, pl. (1837); (Tsang, Tibet).

Perdix hodgsoniæ.—Gould, B. of A., VI., pl. 74 (1857); Adams, P.Z.S., 1859, p. 185 (Ladak); Leadb., P.Z.S., 1861, p. 198 (Hanlee, Tibet); Hume, Nests and Eggs, p. 544 (1873); Cock. and Marsh, S.F., I., p. 349 (1873); Hume, S.F., VII., p. 432 (1878); Hume and Marsh., Game-B., II., p. 65 pl. (1879); Oates' ed. Hume's Nests and Eggs, III., p. 438 (1890), (Indus Valley); Ogilvie-Grant, Cat. B.M., XXII., p. 194 (1893); id. Hand-b. Game-B., I., p. 150 (1895); Oates, Man. Game-B., I., p. 191 (1898); Walton, Ibis, 1906, p. 248 (S. Tibet); Dresser, Ibis 1906, p. 346 (Tibet); Bailey, J. B. N. H. S., XXI, p. 179, (1911); id. ibid. XXII., p. 367 (1913); id. ibid. XXIV., p. 78 (1915).

Perdix hodgsonii.—Adams, P.Z.S., 1858, p. 503 (N. of Mussoorie); Jerdon, B. of I., III., p. 575 (1863).

Perdix (Sæfa) hodgsoniæ.—Gray, Hand-L., B. II., p. 267 (1870).

Perdix hodgsoniæ hodgsoniæ.—Hartert, Vög., Pal., III., p. 1036, (1921).

Vernacular Names.—*Sakpa* (East Tibetan); *Rhakpa* (Central Tibet); *Che-Tra* (Kongbo Tibetan) (F. M. Bailey).

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Description, Adult Male and Female.—Line round the base of the bill black, followed by a white line extending back over the eye as a supercilium; a second black line is followed by the rich chestnut forehead and sides of the crown, the centre of the crown is browner and mottled with black and white; nape and hind-neck greyish brown mottled with white and, to a less extent, with black; a broad chestnut collar at base of hind neck; back, rump and upper tail-coverts blue-grey barred and stippled with black and more faintly with fulvous; the blue tinge is strongest on the inter-scapulars and upper back, and on the latter there are sometimes a few narrow centre lines to some of the feathers; central tail feathers like the upper tail-coverts but more boldly barred, lateral tail feathers chestnut narrowly edged with black stippled fulvous; wing-coverts and inner secondaries with bold central streaks of pale fulvous bordered with black, a few bold bars of deep chestnut and pale fulvous and the rest with fine stippled lines of black, grey and fulvous; quills brown barred with light chestnut and whitish; ear-coverts blackish chestnut with white bases; hind cheeks black; fore cheeks, lores, chin and throat fulvous-white with a black border which joins more or less with the black of the cheeks; fore neck white, or creamy white, with a narrow chestnut band meeting that on the hind neck; below white; the centre of the breast with broad black bars, which sometimes coalesce and form a more or less complete black patch on the belly; sides of breast and flanks marked with chestnut patches and with bold blackish-chestnut bars; vent and under tail-coverts pale fulvous or fulvous-white, sometimes marked with tiny bars of speckly black.

Colours of Soft Parts.—Iris brown or red-brown; orbital skin deep velvety crimson in the breeding season, dull reddish-crimson at other times; bill pale horny green; legs and feet greenish brown or pale livid greenish.

Measurements.—Length about 300 mm.; wing 155 to 165 mm.; tail about 86 to 91 mm.; tarsus about 40 to 43 mm.; culmen about 15 to 17 mm.

The Female is like the male but a little smaller; wing about 150 to 155 mm., and the other measurements in proportion.

The Young Bird has no tinge of blue-grey above, the chestnut is wanting everywhere, and the lower parts are a dull earthy buff, the breast with paler striæ and indefinite narrow bars of dull black. The crown, cheeks and ear-coverts are dark brown with white apical spots.

Distribution.—Tibet from the extreme West to the East, where it meets the race *Perdix hodgsoniæ sifanica*, a smaller and much less richly coloured race. On the West it is found in Ladak, and N.E. Kashmir, has been obtained in the N. E. Bhagiratho Valley near Gangotri. It occurs in Kumaon and is not rare in some of the higher valleys of both Native and British Sikkim. It does not occur, as has

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sometimes been claimed close to Darjiling, nor is the country there suitable for it. It is found in both the Abor and Mishmi Hills in the extreme North, but does not appear to be nearly so numerous there as it is in Tibet.

Nidification.—The Tibetan Partridge breeds in great numbers over practically the whole of Tibet in suitable ground between 11,000 feet and 15,000 feet. Major Barnes took its nest at an elevation of over 16,000 feet, and Mr. Macdonald has obtained eggs for me at places which he tells me are at about 17,000 feet elevation. Probably its favourite situations are on the huge plateau-plains between 12,000 and 14,000 feet. The nest is nothing more than a scratching in the soil, an inch or two deep, and 6 or 7 inches across; in some wind-blown and fallen leaves and grass may collect in the hollows, but in other cases the eggs are laid directly on the bare soil. As a rule the site selected is one protected by rocks or bushes, sometimes it is scratched in amongst the low thorny bushes which cover so great a part of the Gyantse and similar plains, and sometimes, it may be placed at the foot of a single bigger bush or clump of grass. But the eggs may also be taken on ground which is absolutely devoid of all vegetation, in between a couple of rocks or under some boulder. In all cases, however, the nest is placed on the leeward side of the hill and to the leeward of the bush, rock or other protecting cover. The breeding season commences in the end of May and eggs are laid throughout June and early July, occasional clutches, perhaps second layings when the first have been destroyed, in the end of that month and early August. Prjevalsky found a few eggs laid in early May by *P. h. sifanica* in Kansu, though the hens were not then sitting.

They lay from 6 or 7 to 11 and 12 eggs sometimes, perhaps, even more than this, as Prjevalsky speaks of clutches of 15 eggs and over; probably, however, 8 to 10 is the most common number of eggs laid. In appearance they are very much like the Common Partridge's eggs. The colour varies from a pale reddish buff which is rare, through warm buff, olive buff or reddish olive to a warm, clear olive. The shape is normally a rather long oval, the smaller end well pointed and occasionally becoming almost peg-top in character.

The texture is very close and fine, and there is a faint gloss, rarely very highly developed.

One hundred and fifty eggs average 37·6 by 27·2 mm.; the maxima are 43·0 by 26·3 and 39·8 by 28·4 mm., and the minima are 31·1 by 27·8 and 38·1 by 21·9 mm. The minima exclude certain pigmy specimens which are not uncommon in clutches of this Partridge's eggs.

The hen-bird is said to be a very close sitter and an excellent mother, and the cock-bird an equally attentive father and husband.

Habits.—In summer the Tibetan Partridge is found principally between 12,000 and 15,000 feet, but wanders up to nearly 19,000 feet,

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and on the other hand is found down to about 11,000. In winter it keeps below 14,000, and has been found as low as 9,000 feet, though its visits to such comparatively low elevations must be very few and far between.

Hume describes the country in which he found them as very bleak and bare. He says :

> "The entire aspect of the hill where these birds were found was dreary and desolate to a degree—no grass, no bushes, only here and there, fed by the melting snow above, little patches and streaks of mossy herbage, on which, I suppose, the birds must have been feeding."

Colonel F. M. Bailey tells me, however, that the birds do not by preference inhabit the more rugged and bare portions of the Gyantse plain, but are found in places where there are crops, grass or good cover in the way of bushes. In these places they afford good sport, and bags of some size may be made, Colonel Bailey mentioning two days when he obtained 48 and 43 birds in addition to 25 and 34 hares. Elsewhere he records :

> "Found in the crops in the Tsangpo Valley from Pea upwards. They are found in flocks from 10 to 15. Their flight is like that of an English Partridge, but they are not so willing to rise though they are not very wild. When scattered they call each other with a curious buzzing sound. I once heard this exactly imitated by the creaking lid of a lunch-basket which we had out with us when shooting."

Mr. D. Macdonald and others have informed me that when in crops or cover, these birds do not run far, but rise fairly close, and give good shots, though the coveys bunch very much the first time they get up when it is often difficult to avoid "browning" them. After re-alighting they often scatter a good deal, and then afford fine single and double shots, as they rise one after another. When on bare ground, instead of waiting until the shooter is close up to them, they run a great deal, and will often scuttle along in front of one for quite a long distance, stopping every now and then when a dip or hollow in the ground hides them temporarily from view.

It is possible that the bird from the western portion of the range given above, *i.e.*, from Ladak, Kashmir, Garhwal, etc., should be separated as a geographical race. It is much paler than the Tibetan bird, and has little or no bluish tinge above. The broad, rich chestnut collar in that bird is replaced with a narrow yellow-chestnut collar in the Western bird, and the under parts also are paler and duller with the black more extensive and forming a more definite patch. All these variations with the exception of the want of the blue-grey tinge above may be due to bleaching and abrasion, and at present there is not sufficient material in the British Museum to allow of their separation.

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PERDIX HODGSONIÆ SIFANICA.

The Kansu Partridge.

Perdix sifanica.—Prjevalsky, Mongali Strana Tang. II., p. 124 (1876), (Kansu); Bailey, J.B.N.H.S., XXII., p. 367 (1913).

Perdix hodgsoniæ sifanica.—Hartert, Vög. Pal., p. 1937 (1921).

Vernacular Names.—*Sakpa* (East Tibet) *Rhakpa*, (Central Tibet) (F. M. B.)

Description.—Similar to *P. h. hodgsoniæ*, but much less richly coloured, the blue-grey tint on the upper parts is either absent altogether or is confined to the upper back or interscapularies. The lower parts also are duller, and there is less chestnut on the flanks and sides of breast. The black on the cheeks is also less in extent than it is in *P. h. hodgsoniæ*, and never meets below the throat.

Colours of Soft Parts as in the preceding bird.

Measurements.—This is a smaller bird than the last, the wing measuring from 140 to 153 mm., with the other measurements in proportion.

Distribution.—N. E. Tibet, Nanschan, Koko Nor to Scetzschuan.

Nidification.—Eggs taken by Tibetans in extreme North-East Tibet and sent to me by Mr. D. Macdonald are quite indistinguishable from those of the Tibetan Partridge. Prjevalsky found young birds in August in Kansu, but the birds were not sitting in early May, and had only commenced laying.

Habits.—Similar to those of the last bird. Bailey found it between 12,500 and 15,000 feet at suitable places at Litang to Dokeng in the Upper Irrawaddy Valley.

Prjevalsky records:

> "We found this bird in the Alpine regions of Kansu (it does not extend further northwards), principally in the rhododendron thickets about the sources of the Tutunga, where the mountains are covered with small tufts of *Potentilla tenuifolia*. It descends to the plains, which, however, are not at a lower elevation than about 10,000 feet above the sea level.
>
> "Its habits are very similar to those of *Perdix barbata*, only the voice is different. When taking to wing, it utters a more squeaking but louder note than this latter, and its call note is also harsher."

Other observers have noted that the ordinary nuptial call of the breeding male is very like that of *Perdix perdix*, if indeed it is in any way distinguishable from it.

Both this and the last bird eat almost any sort of seed or insect, and for the table Colonel Bailey tells me that he cannot see much difference between *Perdix hodgsoniæ* and the English Partridge.

(*To be continued.*)

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HAND-LIST OF THE "BIRDS OF INDIA."

BY

E. C. STUART BAKER, F.L.S., F.Z.S., M.B.O.U.

PART VI.

(*Continued from page 333 of this Volume.*)

ORDER STRIGES.

Family STRIGIDÆ.

1535. (1152) ***Tyto alba javanica.** *The Indian Barn-Owl.*

Strix javanica *Gmel., S.N., i., p.* 295 (1788), (*Java*).

The whole of India, Ceylon, Burma to Java.

1536. (1152) **Tyto alba deræpstorffi.** *The Andaman Barn-Owl.*

Strix deræpstorffi *Hume, S.F., iii., p.* 390 (1875), (*Andamans*).

Andamans.

1537. (1153) **Tyto candida.** *The Grass-Owl.*

Strix candida *Tickell, J.A.S.B., ii., p.* 572 (1883), (*Borabhum*).

The greater part of India except the W. and N. W. East to Formosa, etc.

1538. (1154) **Photodilus badius badius.** *The Bay Owl.*

Strix badia *Horsf., Res. Java., pl.* 37 (1824), (*Java*).

Eastern Himalayas from Nepal to Assam, Burma to Java and Borneo.

1539. (1155) **Photodilus badius assimilis.** *The Ceylon Bay Owl.*

Phodilus assimilis *Hume, S.F., i., p.* 429 (1873), (*Ceylon*).

Ceylon only.

1540. (1156) **Asio otus otus.** *The Long-eared Owl.*

Strix otus *Linn., Sys. Nat.*, 1, *p.* 92 (1758), (*Sweden*).

Practically all Europe and Asia.

1541. (1157) **Asio flammeus flammeus.** *The Short-eared Owl.*

Strix flammea *Pontoppidan, Danske Atlas, i., p.* 617, *xxv.* (1763), (*Denmark*).

Practically all Europe, N. Africa, N. America and most of Asia.

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*The generic term *Strix* was first applied to birds of another genus (the Tawny Owls) and not to the Barn-Owls. *Tyto* of Billberg, 1828 is the next name available for this genus and *Strix* must replace *Syrnium* of Savigny for the Tawny-Owls or Wood-Owls.

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1542. (1158) **Strix aluco nivicolor.** *The Himalayan Wood-Owl.*

Syrnium nivicolum *Blyth, J.A.S.B., xiv., p.* 185 (1845), (*Himalaya*).

Himalayas from Garhwal to China, and N. Burma.

1543. (1159) **Strix aluco biddulphi.** *Scully's Wood-Owl.*

Strix biddulphi *Scully, Ibis,* 1881, p. 423 (*Gilgit*).

N. W. India from Afghanistan and Baluchistan to Kashmir and Garhwal.

1544. (1160) **Strix indranee indranee.** *The Brown Wood-Owl.*

Strix indranee *Sykes, P.Z.S.,* 1832, *p.* 62 (*Deccan*).

Ceylon and Hills of S. India, N. to Mahableshwar and Orissa.

1545. (1160) **Strix indranee newarensis.** *The Himalayan Brown Wood-Owl.*

Ulula newarensis *Hodg., As. Res., xix., p.* 168 (1836).

Himalayas, East to Assam and the Hills of N. and Central Burma.

1546. (1160) **Strix indranee maingayi.** *The Malay Brown Wood-Owl.*

Syrnium mungayi *Hume, S.F., vi., p.* 29 (1875) (*Malacca*).

Tennasserim.

1547. (1161) **Strix occellata.** *The Mottled Wood-Owl.*

Syrnium occellatum *Less., Rev. Zool.,* 1839, *p.* 389 (*Pondicherry*).

The Plains of India to the extreme S. and E. to Lower Bengal.

1548. (1162) **Strix seloputo.** *The Malayan Wood-Owl.*

Strix seloputo *Horsf., Trans. Linn. Soc., xiii., p.* 140 (1821), (*Java*).

South Burma from Pegu, South to Java, etc. and E. to Siam and Cochin China.

1549. (1163) **Strix butleri.** *Hume's Wood-Owl.*

Asio butleri *Hume, S. F., vii., p.* 316 (1878), (*Omara Mekran Coast*).

Mekran Coast and ? Sinai.

Sub-family BUBONINÆ.

1550. (1164) **Ketupa zeylonensis zeylonensis.** *The Brown Fish Owl.*

Strix zeylonensis *Gmel., Syst. Nat., i., p.* 287 (1788) (*Ceylon*).

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Ceylon, India, East to South China and Hainan, nearly all Burma.

1551. (1164) **Ketupa zeylonensis nigripes.** *The Himalayan Brown Owl.*

Caltrunguis nigripes *Hodg., J.A.S.B., v., p.* 364 (1836), (*Nepal*).

Himalayas from Afghanistan to E. Assam.

1552. (1166) **Ketupa javanensis javanensis.** *The Malay Fish Owl.*

Strix javanensis *Horsf., Trans. L.S., xiii., p.* 141 (1821). (*Java*).

South Burma and Malay Peninsula to Java, Sumatra and Borneo.

1553. (1165) **Ketupa javanensis flavipes.** *The Tawny Fish Owl.*

Caltrunguis flavipes *Hodg., J.A.S.B., v., p.* 364 (1836), (*Nepal*).

Sub-Himalayas from Kashmir East to Assam, Manipur, N. Burma to China.

1554. (1167) **Bubo bubo turcomanus.** *The Turkestan Great Horned Owl.*

Strix turcomana *Eversm., Add. Pall. Zoog. Rosso-As., i., p.* 3 (1835), (*Caspian Sea*).

Transcaspia, Turkestan to N. W. Himalayas.

1555. **Bubo bubo tibetanus.** *The Tibetan Great Horned Owl.*

Bubo bubo tibetanus *Bianchi, Bull. B.O.C., xvi., p.* 69 (1906), (*Chitsu, Tibet*).

Central Tibet to Nan Schan, S. to Sikkim.

1556. (1168) **Bubo bubo bengalensis.** *The Indian Great Horned Owl.*

Otus bengalensis *Frankl., P.Z.S.*, 1831, *p.* 115 (*Bengal*)

India from the South to the Sub-Himalayas and N.E. Burma.

1557. (1169) **Bubo coramandus.** *The Dusky Horned Owl.*

Strix coramanda *Lath., Ind. Orn., i., p.* 53 (1790). (*Coromandel Coast*).

All Central and North India as far East as Bengal.

1558. (1170) **Huhua nipalensis.** *The Forest Eagle-Owl.*

Bubo nipalensis *Hodg., As. Res., xix., p.* 172 (1836), (*Nepal*).

Himalayas and Mts. of S. India, Ceylon, Assam and Burma.

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1559. (1171) **Huhua orientalis.** *The Malay Eagle-Owl.*

Strix orientalis *Horsf., Trans. L.S., xiii., p.* 140 (1821). (*Java*).

S. Tennasserim, Malay Peninsula to Sumatra, Java and Borneo.

1560. (1172) **Nyctea nyctea.** *The Snowy Owl.*

Strix nyctea *Linn., S.N., i., p.* 93 (1858), (*Sweden*).

Mardan, N.W. Punjab. Northern Europe and Asia.

1561. (1173) **Otus scops pulchellus.** *The Eastern Scops Owl.*

Stryx pulchella *Pall., Reise Prov. Russ. Reich., i., p.* 456 (1871), (*Volga*).

S. Eastern Russia, straggler into N.W. India.

1562. **Otus scops sunia.** *The Indian Scops Owl.*

Scops sunia *Hodg., As. Res., p.* 175 (1836), (*Nepal*).

North and Central India.

1563. **Otus scops rufipennis.** *The Southern Indian Scops Owl.*

Scops rufipennis *Sharpe, Cat. B.M., ii., p.* 60 (1875), (*Madras*).

Southern India.

1564. **Otus scops nicobarica.** *The Nicobar Scops Owl.*

Ephialtes nicobaricus *Hume, S.F., iv., p.* 283 (1877), (*Nicobars*).

Nicobars.

1565. **Otus scops minutus.** *The Ceylon Scops Owl.*

Scops minutus *Legge, A.M.N.H.*, (5), *i., p.* 175, (1878), (*Ceylon*).

Ceylon only.

1566. (1174) **Otus brucei.** *The Striated Scops Owl.*

Ephialtes brucei *Hume, S.F., i., p.* 8 (1873), (*Bombay*).

West Turkestan, Afghanistan, Baluchistan and Kashmir, S. to Bombay.

1567 (1175) **Otus spilocephalus.** *The Spotted Himalayan Scops Owl.*

Ephialtes spilocephalus *Blyth, J.A.S.B., xv., p.* 8 (1846), (*Darjiling*).

Himalayas, Murree to E. Assam, N. and Central Burma.

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1568. (1178) **Otus bakkamœna bakkamœna.** *The Collared Scops Owl.*

Otus bakkamœna *Pennant, Ind. Zool., p.* 3 (1769), (*Ceylon*).

Ceylon and S. India.

1569. (1176) **Otus bakkamœna balli.** *The Andaman Scops Owl.*

Ephialtes balli *Hume, S.F., i., p.* 407 (1873), (*Andamans*).

Andamans.

1570. **Otus bakkamœna lempiji.** *The Malay Scops Owl.*

Scops lempiji *Horsf., Trans. L.S., xiii., p.* 140 (1821), (*Java*).

Tennasserim, South to Burma.

1571. **Otus bakkamœna lettia.** *The Nepal Scops Owl.*

Scops lettia *Hodg., As. Res. xix., p.* 176 (1836), (*Nepal*).

Nepal and Garhwal to E. Assam amd N. Burma.

1572. (1179) **Otus bakkamœna plumipes.** *The Kashmir Scops Owl.*

Ephialtes plumipes *Hume, My Scrap-book, p.* 397, (1870), (*Murree*).

N. W. Himalayas.

1573. **Otus bakkamœna semitorques.** *The Japanese Scops Owl.*

Otus semitorques *Temm. & Schl., Siebold's Faun., Jap., p.* 25 (1850), (*Japan*).

Japan Southwards. Very doubtful record from Shan States.

1574. ***Otus bakkamœna deserticolor.** *The Sind Scops Owl.*

Otus bakkamœna deserticolor *Ticehurst, Bull. B.O.C., xlii., p.* 57 (1922), (*Sind*).

Sind, Baluchistan, ? Muscat and Bushire.

1575. (1177) **Otus sagittatus.** *The Large Malay Scops Owl.*

Ephialtes sagittatus *Cass., Pro. Ac. Nat. Sci. Phila., iv. p.* 121 (1850), (*India, Perak*).

Tennasserim, South down the Malay Peninsula.

1576. (1180) **Carine noctua brama.** *The Indian Spotted Owlet.*

Strix brama *Temm., Pl. Col., pl.* 68 (1823), (*India*).

All India N. of 14°, except extreme N. E. Assam and N. Chin Hills.

*This bird may be *Scops semenowi* Zarudy and Harm., Orn. Monatsb., X, p. 49, 1903.

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1577. **Carine noctua fryi.** *The Southern Spotted Owlet.*

Carine brama fryi *Stuart Baker, Bull. B.O.C., xl., p.* 60 (1919), (*Paumbaum, Madras*).

Mysore, Travancore, Deccan, Madras, and Bombay N. to 14°.

1578. **Carine noctua pulchra.** *The Burmese Spotted Owlet.*

Athene pulchra *Hume, S. F., i., p.* 469 (1873), (*Pegu*).

Central and S. Burma, Shan States, Siam Yunnan, Cambodia.

1579. (1181) **Carine noctua blewitti.** *The Forest Spotted Owlet.*

Heteroglaux blewitti *Hume, S. F., i., p.* 468 (1873), (*Phooljan State, W. India*).

Sambulpur, Karial, Khandesh (forests).

1580 (1182) **Carine noctua bactriana.** *Hutton's Owlet.*

Athene bactriana *Hutton, J.A.S.B., xvi., p.* 776 (1847), (*Candahar*).

A straggler only into N.W. India on the Afghan frontier.

1581. **Carine brama tarayensis.** *The Baluchistan Spotted Owlet.*

Noctua tarayensis *Hodg., As. Res., xix., p.* 275 (1836), (*Nepal Terai*).

N. W. India, Baluchistan, Sind and Persian Baluchistan.

1582. (1183) **Glaucidium cuculoides cuculoides.** *The Large Barred Owlet.*

Noctua cuculoides *Vigors. P.Z.S.*, 1830, *p.* 8 (*Himalaya*).

From Hazara to Assam, Burma and Siam.

1583. (1184) **Glaucidium radiatum radiatum.** *The Jungle Owlet.*

Strix radiata *Tickell, J.A.S.B, ii., p.* 572 (1833).

India from the foot of the Himalayas and S. to Madras and Belgaum.

1584. **Glaucidium radiatum malabaricum.** *The Malabar Jungle Owlet.*

Glaucidium malabaricum *Sharpe, Cat. B.M., ii., p.* 218 (1883), (*Malabar*).

Malabar Coast to Ceylon and N. Ceylon.

1585. (1185) **Glaucidium radiatum castanonotum.** *The Chestnut-backed Owlet.*

Athene castanopterus *apud Blyth, J.A.S.B, xv., p.* 280 (*nec. Horsf.*), (1846), (*Ceylon*).

Ceylon in the wetter, hilly country.

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1586. *(1186) **Glaucidium brodiei.** *The Collared Pigmy Owlet.*

Noctua brodiei *Burton, P.Z.S.*, 1835, *p.* 162 (*Himalayas*).

Himalayas, Murree to E. Assam, Burma, China and Malay Peninsula.

1587. (1187) **Ninox scutulata lugubris.** *The Indian Brown Hawk-Owl.*

Strix lugubris *Tickell, J.A.S.B, ii., p.* 572 (1833), (*Dholbhum, Bengal*).

N. India from Rajputana to Bengal.

1588. **Ninox scutulata burmanica.** *The Burmese Brown Hawk-Owl.*

Ninox burmanica *Hume, S. F., iv., p.* 386 (1876). (*Pegu*).

Assam to Burma and Siam.

1589. **Ninox scutulata affinis.** *The Andaman Brown Hawk-Owl.*

Ninox affinis *Tytler, Beavan, Ibis,* 1867, *p.* 285 (*Andamans*).

Andamans and Nicobars.

1590. **Ninox scutulata hirsuta.** *The Ceylon Brown Hawk-Owl.*

Ninox hirsuta *Temm., Pl. Col.*, 289 (1824), (*Ceylon*).

Ceylon.

1591. **Ninox obscura.** *Hume's Brown Hawk-Owl.*

Ninox obscura *Hume, S. F., i., p.* 77, (1873), (*Andamans*)

Andamans and Nicobars.

ORDER ACCIPITRES.†

Family PANDIONIDÆ.‡

1592. (1189) **Pandion haliaetus haliaëtus.** *The Osprey.*

Falco haliaëtus *Linn., S.N.* 10*th ed., i., p.* 91 (1758), (*Sweden*).

Europe, Asia and Africa, winter to India.

Family GYPIDÆ.

1593. (1190) **Ægypius monachus.** *The Cinereous Vulture.*

‖ Vultur monachus *Linn., S.N.*, 12*th ed.* 1, *p.* 122 (1766) (*Arabia*) S. Europe, N. Africa, East to India and China.

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*This little Owl forms several geographical races which require working out.

†This order having just been completely worked by Mr. W. L. Sclater, he has very kindly allowed me to make use of his Ms. and other work for this Catalogue.

‡Very doubtfully separated from the true *Falconidæ* with which it is linked by the genus *Haliaëtus*.

‖*Vultur* applies to a quite different genus and *Ægypius* Savigny, 1809, is the next name applicable.

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1594. (1191) **Torgos calvus.** *The Black or Pondicherry Vulture.*

Vultur calvus *Scop., Del. Flor. et. Faun. Insubr., ii., p.* 85 (1786), (*Pondicherry*).

India to Cochin China and Malay Pen.

1595 (1192) **Gyps fulvus fulvescens.** *The Indian Griffon Vulture.*

Gyps fulvescens *Hume, Ibis,* 1869, *p.* 356, (*Punjab*).

India, not extreme East or Ceylon. ? Red Sea and Suakim.

1596. (1193) **Gyps himalayensis.** *The Himalayan Griffon.*

Hume, Rough Notes, i., p. 12 (1869), (*Simla*).

Himalayas, West from Bhutan to Turkestan and Tibet.

1597 (1194) **Gyps indicus indicus** *The Indian Long-billed Vulture.*

Vultur indicus *Scop., Del. Flor. et Faun. Insubr., ii., p.* 85 (1786), (*Pondicherry*).

Indian Pen., N. to Punjab and Rajputana.

1598 (1194) **Gyps indicus pallescens.** *The Pallid Vulture.*

Gyps pallescens *Hume, S.F., i., p.* 150 (1873), (*Ajmere*).

1599. (1195) **Gyps tenuirostris.** *The Himalayan Long-billed Vulture.*

Hume, S.F., vii., p. 326 (1878), (*Nepal*).

Bengal, Assam and foothills of Himalayas, Burma.

1600. (1196) **Pseudogyps bengalensis.** *The Indian White-backed Vulture.*

Vultur bengalensis *Gmel., S.N. i., p.* 245 (1788), (*Bengal*).

India and Burma to Malay Pen. and Annam.

1601. (1198) **Neophron percnopterus percnopterus.** *The Egyptian Vulture.*

Vultur percnopterus *Linn., S.N., i., p.* 87 (1758), (*Egypt*).

Africa, S. Europe East to N.W. India.

1602. (1197) **Neophron percnopterus ginginianus.** *The Smaller White Scavenger Vulture.*

Vultur ginginianus *Lath., In. Orn. i., p.* 7 (1790), (*Gingee S. India*).

India, S. to Ceylon and E. to Chota Nagpur, etc.

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Family Falconidæ.

Sub-Family Gypaëtinæ.

1603. (1199) **Gypaëtus barbatus grandis.** *The Eastern Bearded Vulture.*

Gypaëtus grandis *Storr., Alpenreise vom Jahr.* 1781—4, *p.* 69 (*Switzerland*).

S. Europe, East to Central Asia, Himalayas and China.

Sub-Family Falconinæ.

1604. (1200) **Aquila chrysaetus daphanæ.** *Himalayan Golden Eagle.*

Aquila daphanæ *Hodg. in Gray's Zool. Misc., p.* 81 (1844), (*Nepal*).

Central Asia, Tianschan and Altai to Himalayas.

1605. (1202) **Aquila heliaca.** *The Imperial Eagle.*

Savigny, Descr. Egipte Says. Ois., p. 82 (1809), (*Upper Egypt*).

E. Europe and N. Africa to India.

1606. (1202) **Aquila nipalensis nipalensis.** *The Eastern Steppe-Eagle.*

Circaëtus nipalensis *Hodg., As. Res., xviii.*, (2), *p.* 13 (1833), (*Nepal*).

Mongolia and S.E. Siberia to the Altai, India and Burma.

1607. (1203) **Aquila rapax vindhiana.** *The Indian Tawny Eagle.*

Aquila vindhiana *Frank, P.Z.S.*, 1831, *p.* 114 (*Vindhya Hills.*)

India to Persian Baluchistan. Not Assam or Ceylon.

1608. (1205) **Aquila clanga.** *The Greater Spotted Eagle.*

Pall. Zoog. Rosso. Asiat. i., p. 351 (1827), (*Russia and Siberia*).

E. Europe to Amur, winter S. to S. Asia and N.E. Africa.

1609. (1206) **Aquila hastata.** *The Small Indian Spotted Eagle.*

Morphnus hastatus *Less., Voy. Ind. Belanger, p.* 217 (1834), (*Bengal*).

India and Burma, not Ceylon.

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1610. (1207) **Hieraëtus fasciatus.** *Bonelli's Eagle.*

Aquila fasciata *Vieill., Mém. Soc. Linn. Paris, ii.*, (2), *p.* 152 (1822), (*Montpellier*).

S. Europe and N. Africa through India to China.

1611. (1208) **Hieraëtus pennatus.** *The Booted Eagle.*

Falco pennatus *Gmel., S.N., i.* (1), *p.* 272 (1788), (*Spain*).

S. Europe and N. Africa to India, Burma and Ceylon.

1612. (1209) **Lophotriorchis kieneri.** *The Rufous-bellied Hawk-Eagle.*

Astur kieneri *de Sparre, Mag. Zool.*, 1835, *Aves, pl.* 35 (*Himalayas*).

India and Burma and Malaya to Philippines; Ceylon.

1613. (1210) **Ictinaëtus malayensis perniger.** *The Indian Black Eagle.*

Aquila, perniger *Hodg., J.A.S.B., v., p.* 227 (1836), (*Nepal*).

India, Ceylon, Burma, S. to Malay Pen.

1614. (1211) **Spizaëtus cirrhatus cirrhatus.** *The Indian Hawk-Eagle.*

Falco cirrhatus *Gmel., S.N., i., p.* 274 (1788), (*India*).

Indian Pen. N. to Rajputana and Central Provinces.

1615. (1212) **Spizaëtus cirrhatus limnaëtus.** *The Changeable Hawk-Eagle.*

Falco limnaëtus *Horsf., Trans. L.S., xiii., p.* 138 (*Java*).

Sub-Himalayan Tracts, Assam, Burma to Philippines.

1616. (1211) **Spizaëtus cirrhatus ceylanensis** *The Ceylon Hawk-Eagle.*

Falco ceylanensis *Gmel., S.N., i., p.* 275, (1788), (*Ceylon*).

Ceylon and Travancore.

1617. **Spizaëtus cirrhatus andamanensis.** *The Andaman Hawk-Eagle.*

Spizaëtus andamanensis *Tytler, P.A.S.B.*, 1865, *p.* 112 (*Port Blair*).

Andamans.

1618. (1213) **Spizaëtus nipalensis nipalensis.** *Hodgson's Hawk-Eagle.*

Nisaëtus nipalensis *Hodg., J.A.S.B., v., p.* 229 (1836), (*Nepal*).

Himalayas and sub-Himalayas, Hazara to Assam.

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1619. (1214) **Spizaëtus nipalensis kelaarti.** *Legge's Hawk-Eagle.*

Spizaëtus kelaarti *Legge, Ibis.*, 1878, *p.* 202 (*Ceylon*).

Ceylon and Travancore.

1620. (1215) **Spizaëtus alboniger.** *Blyth's Hawk-Eagle.*

Nisaëtus alboniger *Blyth, J.A.S.B., xiv., p.* 173 (1845) (*Malacca*).

Tennasserim and Siam and Malay Pen. to Borneo.

1621. (1216) **Circaëtus gallicus.** *The Short-toed Eagle.*

Falco gallicus *Gmel., S.N., i.*, (1), *p.* 259 (1788), (*France*).

Central and S. Europe, N. Africa to India and China.

1622. (1217) **Spilornis cheela cheela.** *The Indian Crested Serpent-Eagle.*

Falco cheela *Lath., Ind. Orn., i., p.* 14 (1790), (*Lucknow*).

Himalayas, Kashmir to Sikkim, winter Southwards.

1623. (1217) **Spilornis cheela rutherfordi.** *The Hainan Serpent-Eagle.*

Spilornis rutherfordi *Swinh., Ibis*, 1870, *p.* 85 (*Central Hainan*).

Assam, Burma and Siam to Hainan.

1624. (1217) **Spilornis cheela albida.** *The Lesser Serpent-Eagle.*

Falco albidus *Temm., Pl. Col.*, 4, *pl. xix.* (1824), (*Pondicherry*).

Southern India.

1625. (1217) **Spilornis cheela spilogaster** *The Ceylon Serpent-Eagle*

Hæmatornis spilogaster *Blyth, J.A.S.B., xxi., p.* 351 (1852), (*Ceylon*).

Ceylon only.

1626. (1217) **Spilornis cheela davisoni.** *The Andaman Serpent-Eagle.*

Spilornis davisoni *Hume, S.F., i., p.* 307, (873), (*S. Andamans*).

Andaman and Nicobar Is.

1627. (1217) **Spilornis cheela ricketti.** *The Chinese Serpent-Eagle.*

Scl., Bull. B.O.C., xl., p. 37 (1919), (*Yamakan, Fokien*).

Mt. of S. China to Chindwin, U. Burma.

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1628. (1217) **Spilornis cheela bassus.** *The Malayan Serpent Eagle.*

Falco bassus *Forster in Le Vaill. Nat. Af. Vog., p.* 55 (1798).

Malay Pen. S. Tennasserim to Sumatra.

1629. (1218) **Spilornis minimus.** *The Nicobar Serpent-Eagle.*

Hume, S.F., i., p. 464 (1873), (*Camorta, Nicobars*).

Northern group of Nicobars.

1630. (1219) **Spilornis elgini.** *The Andaman Serpent-Eagle.*

Tytler, J.A.S.B., xxxii., p. 87 (1863), (*S. Andaman Is.*)

Andaman Is.

1631. (1219) **Spilornis klossi.** *Kloss' Serpent-Eagle.*

Richmond, Pro. U.S. Nat. Mus., xxv., p. 304 (1902) (*Great Nicobars*).

Great Nicobars.

1632. (1220) **Butastur teesa.** *The White-eyed Buzzard.*

Cirius teesa *Frankl., P.Z.S.*, 1831-2, *p.* 115 (*Ganges, Nerbudda*).

All India, E. to Burma.

1633. (1221) **Butastur liviventer.** *The Rufous-winged Buzzard-Eagle.*

Falco liviventer *Temm., Pl. Col.* 74, *pl.* 438 (1877), (*Java*).

Burma, Siam and Celebes and ? Java and Timor.

1634. (1222) **Butastur indicus.** *The Grey-faced Buzzard-Eagle.*

Falco indicus *Gmel., S.N., i., p.* 264 (1788), (*Java*).

Breeding N.E. Asia, winter South. Straggler N. Burma.

1635. (1223) **Cuncuma leucorypha.** *Pallas' Fishing-Eagle.*

Aquila leucorypha *Pall., Reise. Russ. Reichs, i., p.* 454 (1771), (*Lower Ural R.*).

S. Russia to Transbaikalia and N. India and Burma.

1636. (1224) **Cuncuma leucogaster.** *The White-bellied Sea-Eagle.*

Falco leucogaster *Gmel., S.N., i., p.* 257 (1788), (*New South Wales*).

Coasts of India, Ceylon, Burma and S. China to Australia.

1637. (1225) **Haliaetus albicilla.** *The White-tailed Sea-Eagle.*

Falco albicilla *Linn., S.N., i., p.* 89 (1758), (*Sweden*).

Breeding N. Europe and Asia, winter to India, etc.

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1638. (1226) **Polioaëtus ichthyaëtus.** *The Large Grey-headed Fishing Eagle.*

Falco ichthyaëtus *Horsf., Trans. L.S., xiii., p.* 136 (1821). (*Java.*)

India, Ceylon, Burma to Philippines.

1639. (1227) **Polioaëtus humilis humilis.** *The Malayan Fishing Eagle.*

Falco humilis *Müll. & Schleg., Verh. Nat. Gesch. Aves., p.* 47 (1840), (*Sumatra*).

Sumatra, etc., Malay Pen., to South Tennasserim.

1640. (1227) **Polioaëtus humilis plumbeus.** *The Himalayan Fishing-Eagle.*

Polioaëtus plumbeus *Jerdon, Ibis,* 1871, *p.* 336, (*N. W. Himalayas*).

Sub-Himalayas, Kashmir to Assam and Upper Burma.

1641. (1228) **Haliastur indus indus.** *The Brahminy Kite.*

Falco indus *Bodd., Tabl. Enl.*, 1783, *p.* 25 (*Pondicherry*).

India, Ceylon, Burma, Malay Pen., Indo China and China.

1642. {(1229) (1231)} **Milvus migrans govinda.** *The Common Pariah Kite.*

Milvus govinda *Sykes, P.Z.S.*, 1832, *p.* 89 (*Deccan*).

India, Ceylon, Burma, Malay Pen., Siam to Hainan.

1643. (1230) **Milvus migrans lineatus.** *The Black-eared Kite.*

Haliaëtus lineatus *Gray in Hard., Ill. Ind. Zool., i., p. i.* (1832), (*China*).

Central Asia S. to Himalayas, E. to Japan, winter widely spread.

1644. (1232) **Elanus cœruleus cœruleus.** *The Black-winged Kite.*

Falco cœruleus *Desfon., Hist. Acad. Roy., Paris.* 1787-9, *p.* 503 (*Algiers*).

Africa from Algiers, E. to India, Ceylon, Burma, etc

1645. (1233) **Circus macrourus.** *The Pale Harrier.*

Accipiter macrourus *S. G., Gmel., N. Comm., Acad. Petro., xv., p.* 439 (1771), (*Veronitz, Volga*).

Roumania to Altai ; winter to India, Ceylon, Burma and Africa.

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1646. (1334) **Circus pygargus.** *Montagu's Harrier.*

Falco pygargus *Linn., S. N., p.* 89 (1758), (*England*).
Europe and N. Asia, winter South.

1647. (1335) **Circus cyaneus.** *The Hen Harrier.*

Falco cyaneus *Linn., S.N., i., p.* 126 (1766), (*Near London*).
Europe and N. Asia, winter South.

1648. (1236) **Circus melanoleucus.** *The Pied Harrier.*

Falco melanoleucus *Forst. Ind. Zool., p.* 12 (1781), (*Ceylon*)
N. E. Asia, South in winter.

1649. (1237) **Circus æruginosus æruginosus.** *The Marsh Harrier.*

Falco æruginosus *Linn., S.N., p.* 91, (1858), (*Sweden*).
Europe and N. Asia, winter southwards.

1650. (1238) **Circus spilonotus.** *The Eastern Marsh Harrier*

Kaup. in Jard., Con. Orn., p. 59 (1850), (*Asia, Philippines*)
Transbaikalia and Tibet, winter southwards.

1651. (1239) **Buteo ferox.** *The Long-legged Buzzard.*

Accipiter ferox, *S.G., Gmel. Nov. Comm. Acad., Petro., xv. p.* 442 (1771), (*Astrakan*).
S. and Central Russia and Central Asia to Himalayas.

1652. (1240) **Buteo hemilasius.** *The Upland Buzzard.*

Temm. & Schleg. in Sieb. Faun. Jap., p. 16 (1845) (*Japan*).
Eastern Asia, S. to Himalayas and S. China.

1653. (1241) **Buteo buteo rufiventer.** *The Desert Buzzard.*

Buteo rufiventer *Jerd., Madr. Jour. L.S., xiii., p.* 165 (1844), (*Nilghiris*).
Breeding S.E. Russia, Asia Minor and Persia, S.E. in winter.

1654. (1241) **Buteo buteo japonicus.** *The Japanese Deser Buzzard.*

Falco buteo japonicus *Temm. & Sch. in Sieb. Faun. Jap., p.* 16 (1845), (*Japan*).
Breeding in Turkestan to Higher Himalayas.

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1655. (1243) **Astur gentilis schvedowi.** *The Eastern Goshawk.*

Astur palumbarius schvedowi Menzb., Orn. Geogr. Eur., Russ. in Mem. s.c., Un. Imp. Mosc., p. 439 (1882), (*Transbaikalia*).

Northern Asia and S. to N. India, Burma and Central China.

1656. (1244) **Astur badius badius.** *The Ceylon Shikra.*

Falco badius *Gmel., S.N., i., p.* 280 (1788), (*Ceylon*).

Ceylon and Travancore.

1657. (1244) **Astur badius dussumieri.** *The Shikra.*

Falco dussumieri *Temm., Pl. Col. livr.* 52, *pl.* 308 (1824), (*Bengal*).

N. India from Kashmir to North Assam.

1658. (1244) **Astur badius poliopsis.** *Hume's Shikra.*

Micronisus poliopsis *Hume, S.F., ii., p.* 325 (1874), (*Thayetmyo*).

S. Assam, Burma, S. to Trang and E. to Hainan.

1659. (1244) **Astur badius cenchroides.** *Severtzov's Shikra.*

Astur cenchroides *Severtz., Turkes. Jevit., p.* 63 (1873), (*Turkestan*).

Turkestan to Baluchistan, Sind and Punjab.

1660. **Astur butleri.** *Butler's Shikra or Goshawk.*

Gurney, Bull. B.O.C., vii., p. xxvii. (1898), (*Car Nicobar*)

Nicobar Islands.

1661. **Astur obsoletus.** *Richmond's Shikra or Goshawk.*

Richmond, Pro., U. S. Nat. Mus., xxv., p. 306 (1902) (*Katchal*).

Nicobar Islands.

1662. (1245) **Astur soloensis.** *Horsfield's Goshwak.*

Falco soloensis *Horsf., Trans. L.S., xiii., p.* 137 (1821), (*Java*).

Breeding China, S. in winter to Assam, Burma, etc.

1663. (1246) **Astur trivirgatus trivirgatus.** *The Crested Goshawk.*

Falco trivirgatus *Temm., Pl. Col., pl.* 303, (1824), (*Sumatra*) South India, May. Pen and Java, etc.

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1664. (1246) **Astur trivirgatus rufitinctus.** *The Great Crested Goshawk.*

Spizaëtus rufitinctus *McClell., P.Z.S.,* 1839 *p.* 153 (*Assam*).

N. India, Burma to Formosa and Hainan.

1665. (1247) **Accipiter nisus nisosimilis.** *The Asiatic Sparrow-Hawk.*

Falco nisosimilis *Tick., J.A.S.B., ii., p.* 571, (1833), (*Bengal, Borabhum*).

Breeding Turkestan to Japan. Winter India, etc.

1666. (1247) **Accipiter nisus melanoschistus.** *The Indian Sparrow-Hawk.*

Accipiter melanoschista *Hume, Ibis,* 1869, *p.* 356 (*Kotegarh*).

Himalayas, Kashmir to Assam and N. Burma, etc.

1667. **Accipiter gularis.** *The Japanese Sparrow-Hawk.*

Astur gularis *Temm. & Schleg. in Sieb., Faun., Jap., p.* 5 (1845), (*Japan*).

Breeding N. E. Asia. Rare straggler to Burma in Winter.

1668. (1248) **Accipiter virgatus besra.** *The Besra Sparrow-Hawk.*

Accipiter besra *Jerd., Madr., Jour. L.S., x., p.* 84 (1839) (*S. India*).

S. India and Ceylon.

1669. **Accipiter virgatus affinis.** *The Larger Besra Sparrow-Hawk.*

Accipiter affinis *J. E. Gray, Zool. Misc., p.* 81 (1844) (*Nepal*).

Himalayas from Pindi to Assam, Burma, China, etc.

1670. (1249) **Pernis cristatus ruficollis.** *The Indian Crested Honey-Buzzard.*

Pernis ruficollis *Less., Traité d'Orn., p.* 76 (1831),(*Bengal*), India, Ceylon, Burma, Malay Pen. to Siam and S. China.

1671. (1250) **Machærhampus alcinus.** *The Slender-billed Pern.*

Westermann, Bigd. t. d. Dierk, i. (2), *p.* 29 (1851), (*Malacca*).

S. Tennasserim, Malay Pen. to New Guinea.

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1672. (1251) **Lophastur leuphotes leuphotes.** *The Black-crested Baza.*

Falco leuphotes *Dumont, Dict. Sci. Nat., xvii., p.* 217 (1820), (*Pondicherry*).

Nepal Terai, Bengal, Travancore and Ceylon.

1673. (1251) **Lophastur leuphotes burmana.** *The Burmese Black-crested Baza.*

W. L. Sclater, Bull. B.O.C., xli., p. 31 (1920), (*Malucom*),

Assam, Burma, Siam, Indo China to Malay Pen.

1674. (1252) **Aviceda jerdoni jerdoni.** *Blyth's Baza.*

Lophastur jerdoni *Blyth., J.A.S.B., xi., p.* 464 (1842), (*Malacca*).

Sikkim, Assam, Burmese Hills to Malay Pen. and Sumatra.

1675. (1253) **Aviceda jerdoni ceylonensis.** *Legge's Baza.*

Baza ceylonensis *Legge, S. F., iv., p.* 247 (1876), (*Kandy Ceylon*).

Ceylon, Travancore, Wynaad.

1676. (1254) **Falco peregrinus calidus.** *The Siberian Peregrine Falcon.*

Falco calidus *Lath., Ind. Orn., i., p.* 41 (1790). (*India*).

Breeding N. and Central Asia. Winter S. to India, Burma, Ceylon, etc.

1677. (1255) **Falco peregrinus peregrinator.** *The Indian Peregrine Falcon.*

Falco peregrinator *Sund., Phys. Sall. Tid., i., p.* 177 (1837), (*Indian Ocean*).

India, Ceylon and Burma in hill country.

1678. (1256) **Falco peregrinus babylonicus.** *The Red-capped Falcon.*

Falco babylonicus *Gurney, Ibis,* 1861, *p.* 218 (*Oudh*).

Breeding Mesopotamia to Turkestan and Baluchistan.

1679. (1257) **Falco jugger.** *The Laggar Falcon.*

Gray in Hard., Ill. Ind. Zool., ii., pl. 26 (1833-4), (*India*).

India and N. Burma.

1680. (1258) **Falco cherrug cherrug.** *The Saker Falcon or Cherrug.*

Falco cherrug *Gray, op. cit., pl.* 25 (1833-4), (*India*).

S. E. Europe and Central Asia, winter S. to India, etc.

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1681. (1259) **Falco cherrug milvipes.** *Hodgson's Saker or Shanghar Saker.*

Falco milvipes *Hodg., in Gray's Zool. Misc., p.* 81 (1844) (*Nepal*).

Central Asia, winter to India, etc.

1682. (1260) **Falco subbuteo subbuteo.** *The Hobby.*

Falco subbuteo *Linn., S.N., p.* 89 (1758), (*Sweden*).

Europe and N. Asia, straggler to India in winter.

1683. (1260) **Falco subbuteo streichi.** *The Chinese Hobby.*

Hartert & Neum., Jour. f. Orn., 1907, *p.* 572 (*Swatow, S. China*).

China, visitor to Burma.

1684. (1261) **Falco severus severus.** *The Burmese Hobby.*

Falco severus *Horsf., Trans. L.S., xiii., p.* 135 (1822), (*Java*).

Assam, Burma and Indo China to Philippines.

1685. (1261) **Falco severus indicus.** *The Indian Hobby.*

A. B. Meyer & Wiglls., B. of Celebes, i., p. 84 (1897)*i* (*Calcutta*).

Himalayas to Travancore and Ceylon.

1686. (1262) **Falco vespertinus amurensis.** *The Eastern Red-footed Falcon.*

Falco vespertinus var. amurensis *Badde, Reis. Ost. Sib., ii., p.* 110 (1863), (*Blagowestschensk, Amur, Siberia*).

Central and E. Siberia, S. in winter to Africa, India, China, etc.

1687. (1263) **Falco columbarius insignis.** *The Asiatic Merlin.*

Æsalon regulus insignis *Clark, P.U.S. Nat. Mus., xxxi., p.* 470 (1907), (*Corea*).

Northern Asia, S. in winter.

1688. (1264) **Falco chiquera chiquera.** *The Red-headed Merlin.*

Falco chiquera *Daudin, Traité, ii., p.* 121 (1800), (*Bengal*).

India, West to Quetta, East to Assam.

1689. (1265) **Falco tinnunculus tinnunculus.** *The Kestrel.*

Falco tinnunculus *Linn., S.N., p.* 90 (1758), (*Sweden*).

In winter to India, Burma and Ceylon.

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1690. (1265) **Falco tinnunculus interstinctus.** *The Indian Kestrel.*

Falco interstinctus *McClell., P. Z. S.*, 1839, *p.* 154 (*Assam*).

Breeding Mts. of India and Burma to W. China.

1691. (1266) **Falco naumanni pekinensis.** *The Chinese Lesser Kestrel.*

Falco cenchris var. pekinensis *Swinh., P.Z.S.*, 1870, *p.* 442 (*Pekin*).

N. China, S. in winter to India, Burma, etc.

1692. (1267) **Microhierax cœrulescens cœrulescens.** *The Red-legged Falconet.*

Falco cœrulescens *Linn., S.N.*, *p.* 88 (1758), (*Bengal*).

Sub-Himalayas, Kumaon to Assam.

1693. (1267) **Microhierax cœrulescens burmanicus.** *The White-breasted Falconet.*

Swann, Synop., Accip. p. 116 (1920), (*Thayetmyo*).

Burma, Siam, Cambodia, Annam.

1694. (1268) **Microhierax melanoleucus melanoleucus.** *White-legged Falconet.*

Ierax melanoleucus *Blyth, J.A.S.B, xii., p.* 179 (1843) (*Assam*).

Assam, to Indo China.

1695. (1269) **Microhierax fringillaris.** *The Black-legged Falconet.*

Falco fringillaris *Drap., Dict. Class. d'Hist. Nat., vi., p.* 412 (1824), (*Malacca*).

Tennasserim, S. to Borneo.

1696. (1270) **Poliohierax insignis.** *Fielden's Falcon.*

Poliohierax insignis *Walden, P.Z.S.*, 1871, *p.* 627 (1872) (*Toungo*).

Burma.

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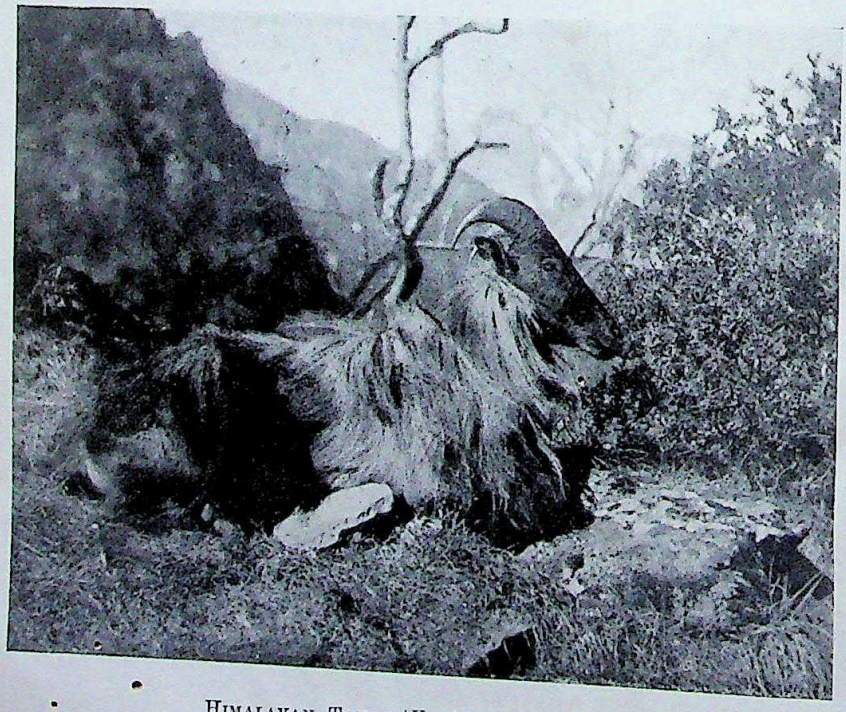
HIMALAYAN IBEX (*Capra sibirica*)
Shot in Baltistan by Maj. C. H. Stockley.



HIMALAYAN TAHR (*Hemitragus jemlaicus*)
Shot in Kishtwar by Maj. C. H. Stockley.
(*Photos contributed by Maj. C. H. Stockley.*)

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GAME ANIMALS OF KASHMIR AND ADJACENT HILL PROVINCES.

BY

COL. A. E. WARD.

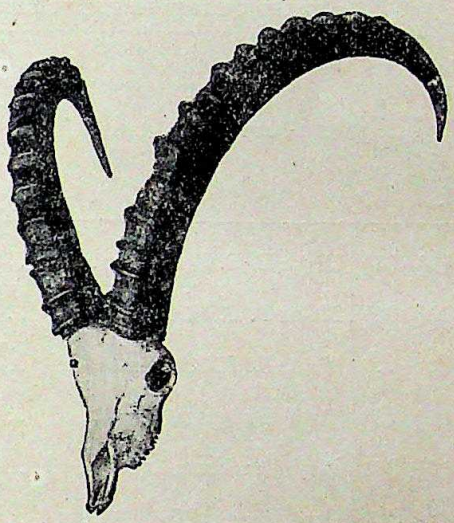
Part III.

(*Continued from page 344 of this volume.*)

(*With 1 plate and 4 text figures.*)

GOATS.

No. 348. THE HIMALAYAN IBEX. (*Capra sibirica.*)



Himalayan Ibex (*Capra sibirica*)

(From the Society's collection. 45″).

The "*Kheyl*" of Kashmiris.

The spring is the season for Ibex shooting, when they come down to the green grass from their winter quarters during the morning and evening hours. They may even stay in the valleys during the day, provided the country is undisturbed, and there are no snow leopards on the prowl. In addition cliffs must be adjacent to the grazing grounds. An ibex seems to be only at ease when lying amongst the precipices from whence he can look down and watch the low ground whilst a "nanny" does sentry duty in the vicinity.

In the spring the flocks of Ibex are fairly large, and all sizes are banded together, but in the summer the larger bucks wander off to the heights, leaving the females and kids on the lower ground.

In the summer, say after June, shooting is difficult, many a stalk is spoilt by the mist which drives up from below, and lands the gunner in difficulties.

Ibex come to grief in avalanches, for even in the winter they generally keep up at great elevations. In the Indus valley, Baltistan Ibex come low down in winter, for the cliffs on that river are at a low altitude. There is no other suitable ground at hand except perhaps in Dachin and the lower Wardwan, hence they have to remain high up.

How do Ibex exist on the heights during the winter? they must be endowed with the power of living on very little food. Places where Ibex have wintered can be found: one was between two almost parallel lines of cliffs on the

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southern side of a hill; from the foot of one lot of cliffs a steep slope ran to the top of the next line of precipices. The upper cliffs overhung the slope. Many traces remained, and hair, skin and the horns of females were lying on the ground. Very possibly the Ibex were starved to death, and bears or vultures got to work and broke up the dead goats.

Another winter quarter was much trampled; it was practically a large cave with a wide opening to the south. Hair was plentiful, but no skin or bones, so probably all went well, but very short rations must have been the rule.

Measurement of Ibex Horns.

OMITTING THOSE FROM THE PAMIR.

Index No.	Measurements			Name of Sportsman	Date	Locality, etc.
	Length	Girth	Tip to Tip			
1	55	11½	35½	Major B. E. M. Gurdon.. ..	1905	Gilgit.
2	53	10¼	34¼	Major B. E. M. Gurdon.. ..	1904	Gilgit.
3	51⅞	..	..	Major E. H. S. Thomas ..	1917	Gilgit.
4	51	10¼	29	F. W. Hodgkins	1908	Gilgit.
5	50½	10¼	35	Major Anderson..	1908	Baltistan
6	50	11	26	Capt. Nugent Head	1920	Baltistan.
7	50	10¼	23	Capt. Bruce	1908	Baltistan.
8	50	10¼	..	J. B. Somerville..	1909	Baltistan (1 tip broken).
9	50	10⅛	..	Capt. E. W. Palmer	1909	Baltistan.
10	50	10	22½	F. W. Hodgkins	1908	Gilgit.
11	50	10	..	A. E. Ward	1887	Zogila (Found dead).
12	49½	10	27	F. W. Hodgkins	1909	Gilgit.
13	49	11	..	Col. Cuppage	..	Lidarwat, Kashmir.
14	49	11	..	Picked up by a shikari ..	1885	Lidarwat.
15	49	11	30	W. Wainright	..	Gilgit.
16	49	10¼	33½	H. H. Cripps	1909	Baltistan.
17	49	10¼	20	G. S. Cooper	1907	Ladak.
18*	49	10	19½	Capt. L. Murray	1907	Baltistan (Braider).

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Index No.	Measurements: Length	Measurements: Girth	Measurements: Tip to Tip	Name of Sportsman	Date.	Locality, etc.
19	49	9¾	36	Capt. L. Murray	1907	Baltistan.
20	48½	11¼	34	A. E. Ward	1881	Wardwan.
21	48½	..	..	Capt. R. A. Lowther	1921	Baltistan
22	48½	10½	31	R. H. R. Brocklebank	1905	Ladak.
23	48½	..	..	A. C. Charlington	1903	Baltistan
24	48	11¼	16	C. C. McGregor	1913	Baltistan.
25	48	11	23	K. A. Jenkins	1911	Astor.
26	48	10½	25½	Capt. Purchas	1921	Kishtwar.
27	48	..	..	C. M. Denkin	1911	Baltistan.
28	48	..	31	R. V. C. Bodley	1913	Baltistan (Brander.)
29	48	10	32½	V. F. Byrnes	1919	Baltistan.
30	48	..	..	Capt. Nugent Head	1920	Baltistan
31	47¾	10½	34	R. H. R. Brocklebank	1905	Ladak.
32	47½	9¾	..	Capt. J. F. Barrington ..	1912	1 tip broken
33	47½	9½	14¼	J. G. Apcar	1906	Baltistan.
34	47	..	..	Capt. Campbell	1900	Gilgit.
35	47	..	..	Capt. McConaghey	1901	Gilgit.
36	47	10¾	35	G. N. Deas	1920	Baltistan
37	47	10½	..	Capt. S. B. Patterson	1905	Ladak
38	47	10¼	35	Lady Constance Stewart Richardson. ..		Baltistan.
39	47	10	20	G. H. McGaw	1907	Baltistan.
40	47	..	..	Capt. Miller Hallett	1918	Gilgit.
41	47	..	..	Capt. Williamson	1919	Baltistan.

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Index No.	Measurements			Name of Sportsman	Date	Locality, etc.
	Length	Girth	Tip to Tip			
42	47	..	..	Major MacCullock	1920	Baltistan.
43	47	9½	24½	Capt. A. G. Eden	1913	Baltistan.
44	46¾	11	..	Capt. Jeffereys	1905	Baltistan.
45	46¾	10¼	..	G. Des Vieux	1910	Hushai.
46	46¾	9¾	25¼	G. P. Radclyffe	..	Baltistan.
47	46½	10½	23½	Capt. Bogle	1904	Gilgit.
48	46½	..	..	H. C. Strong	1908	....
49	46½	..	..	Capt. Bickford	1917	Cherkila
50	46	11	..	A. E. Ward	1887	Astor.
51	46	11	..	Capt. S. B. Patterson	1905	Baltistan.
52	46	10½	17¾	R. Walpole	..	Baltistan.
53	46	10½	26½	Major J. F. P. Langdon ..	1907	Baltistan.
54	46	10½	31	V. A. R. Stokes	1911	Baltistan.
55	46	9½	26½	Warton	1904	Baltistan.
56	46	9½	16¾	R. S. B. Aldsey..	1904	Baltistan.
57	46	..	..	Major E. H. S. James	1917	Gilgit.
58	46	..	..	Capt. S. Stuart Mellow ..	1920	Baltistan.
59	46	..	..	Major MacCullock	1920	Baltistan.
60	46	..	..	L. G. McKinsuey	1921	Wardwan.

Between 45″ and 46″ there is a list of 30 heads, of these one has a girth of 11½″ shot by Mr. Lucas Tooth in Astor. Two girthed 11″ one shot by Mrs. Hext in Baltistan, the other by A. E. Ward in Dumoot. Since peace was concluded twelve heads measuring between 45″ and 48½″ in length have been recorded. Ibex shooting within the watershed of the Jhelum is now prohibited.

The records of old date prove that very big horns were got in Kashmir proper. Look at the measurements of Nos. 13 and 14. Not long ago a fine herd was seen in another branch of the Liddar Valley. It is an open question whether the prohibition regarding shooting will give good results. The best guardian of a shooting block is the license holder; he can of course shoot up to his limit, but what is that compared with the number that the goat-herds can slay, and besides this the sportsman would naturally try to kill leopards and bears. A Botanist or a Field Naturalist may now and again visit the heights of Kashmir, but on their own job, not to hunt game.

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Tian Shan Ibex.

Index No.	Measurements: Length	Measurements: Girth	Measurements: Tip to Tip	Name of Sportsman	Date	Locality, etc.
1	59½	13½	52½	P. F. Hadow, Esq. ..	1907	Tian Shan.
2	56¾	10¼	23¾	P. F. Hadow, Esq. ..	,,	,,
3	56	..	..	Picked up in the Tagdumbash and measured by two travellers.	,,	
4	53⅛	10¾	34	P. F. Hadow, Esq. ..	,,	,,
5	53	11½	28¾	P. F. Hadow, Esq. ..	,,	,,

To hark back to the hill side and records of sport.

A flock of Ibex were seen on the right bank of a snow-fed stream which was for the time being a torrent. The flock was too far off to tell whether any bucks were about, hence the necessity to climb and get nearer. The ascent had to be made up a ravine which joined the main river higher up; the ridge was then crossed and the ground searched. Nothing was to be seen. A move was then made to the "snowed stream" where behind some rocks breakfast and a rest were taken.

Opposite and across the stream were precipitous rocks along which narrow uneven ledges passed along the face of the cliff.

Reading the newspapers and writing up the journal took off attention, but the local shikari was on the alert, and crawling up he whispered "Kheyl"! On the narrow ledge were two bucks, which had come from opposite directions and were a close at hand. As they approached one another both stood still; one or the other was bound to turn, for if they fought at any rate one would fall into the torrent below and be swept away. After a time the bigger of the two raised himself on his hind legs for a second and then stood still; this was too much for the other, he turned, keeping his horns outwards very cleverly and fled. The big one then slowly advanced, affording a very tempting shot, but he would have fallen down the cliff and would never have been retrieved in the torrent.

It does not take long to write up the story, but on the vast hill side, it is a different matter. Descending was a long job. The ridges above the rocks had to be negotiated until the forest was reached, and a couple of small trees shoved across a narrow gorge. On the far side of the stream the modest camp was pitched just before dark. At dawn a man was sent up and told to try and find the flock, or the two bucks; there was almost certain to be a flock for it was still spring time. Obedient to orders the man returned directly he had sighted the Ibex, but the wind was wrong and there was no chance of an approach from below. Very early on the next day a move upwards was made, the ground above the cliffs was easy going and the Ibex were soon located. On a slope above the rocks, two were playing; rising on their hind legs they made a great show of

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fighting but evidently they were not in earnest. Here and there the rest of the flock were feeding. Suddenly the " nanny " on guard whistled, at once the two stopped playing and with them all turned upwards. Amongst them probably were the two which met on the narrow ledge. There was no time to delay and what was evidently a grand beast was fired at. It was a nasty one-quarter-on shot and he staggered as the bullet struck him, and moved on, until the left barrel brought him to a recumbent position almost behind a big stone. When he was reached he could not get up.

What a difficult shot it is when the quarry is feeding under a cliff and the gunner is trying to get into position by looking over from above! Under these circumstances, it affords one very little comfort for the shikari to say he will hold on to one and stop a fall, somehow the rifle will not get into position and feels as if it must be dropped. Now and again this predicament is sure to come. For days three good bucks had been watched. On one occasion the mist came up, on another they fairly won the game by moving steadily away, they had not got the wind nor were they frightened, but went on and on over very difficult ground. At last it was settled to go to a cave high up in the hills, so food and bedding with a change of clothes were taken, and as luck turned out 4 or 5 men including the old gun bearer and local shikari.

The cave floor was spread with creeping juniper boughs, and a small bundle of pitch pine splinters was taken in order to light the fire. After a long search the bucks were found under a cliff which stood erect bordering a small ravine. They were not more than 100 feet below and it was from the top of this cliff that the attempt was made. The bullet struck the ground some distance beyond the Ibex. They rushed up the ravine and turned to the left giving fairly easy shots. Two ·500 bore rifles had been taken out and four barrels were in all fired.

Fairly big bore rifles do not lend themselves to much fusilading, and there were consequently many wounded animals.

One Ibex fell, a second was not fired at, and the third could not be seen for some seconds, then he was spotted slowly labouring upwards, very hard hit and on his last legs. He stopped and stood broadside on, and would have given an easy shot for a high velocity small bore, but was out of range for the ·500.

Watching through the telescope, the buck was seen to double his legs under him, slowly sink on his stomach and fall on his side. On reaching him the mark of the bullet showed in the middle of the ribs.

The summer was advancing, and unsettled weather was coming from below. The local shikari fussed and wanted to cut off the Ibex head and bolt downwards, but the lust for meat caused the other men to skin and cut up the carcases. Before this operation was over, snow began to fall and a hurried return was made to the cave, where luckily a few half burnt sticks remained from the morning's fire. Everything was thrown into the cave, and everyone collected juniper boughs until the snow was thick on the ground. For two days snow fell heavily, then the sun shone, and the soft snow began to slide down the slopes making a move impossible until the fourth day.

Dry chupatties and a little revolting Ibex meat is poor food even when washed down with brandy and smoky water!

One head was a very fine one and taped over 48 inches in length; a typical Wardwan head of the best. The other horns were not diminutive but were too small to bother much about and as there was much to be carried they were left in the cave with the intention of sending for them later on. This however never came off. Twice has a cave been useful and practically afforded preservation. When there is no leakage from melting snow, it is all right being dry, although a bit dreary, but when there is no dry place except on a bundle of juniper boughs it is trying.

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Probably it is even harder to kill game with the sun facing the gun than it is to do so when shooting directly downwards. A start is generally made in the early morning when the sun is behind the hills, but often a great deal of time is lost whilst getting over bad ground, and just as the last few yards have to be passed the sun tops the hill, and the difficulty of looking along the barrel and taking a fine sight is so great that a shot at 50 yards is often clean missed. What with the wind changing and regard having to be taken as to the sun, mist driving up, and bad ground, no one can expect successful sport after Ibex without much patience and endurance, and it may be added that good food is a necessity. If suitable ground for an approach is impossible, and the Ibex are in a ravine, they can be brought up to the gun, by sending a couple of intelligent men to give them the wind. On two occasions this method came off well, but often it fails.

Whilst seated behind a rock just under the head of the ravine, in fact almost on the crest, a large herd streamed passed, but there were no males worth shooting. In another drive, if it could be called so, the Ibex came in a flock and behind them was a Thar. This was luck, for the coolies were clamouring for meat, and were short of rice. The Thar supplied this want, and also saved the pricking of conscience, for enough Ibex had been killed during the trip, and somehow the proceedings did not seem to be fair.

Long ago when there were no game laws the Governor of Leh gave an entertainment in the Basgo Nullah (on the road to Ladak) which in those days was full of Ibex.

The camp was pitched close to the Ladak road, where a crowd of Ladakis had assembled with their dogs. Some very fine Baltistan dogs, not unlike the big lurchers, were also in camp, but they were not vicious, while on the contrary no stranger dare go near the Ladaki hounds.

The Governor explained that the Basgo ravine would be surrounded and the dogs would be let loose, the Ibex would go into the cliffs and probably stand. From the point of view of a strange sight the drive was a success on the whole, but as a sporting undertaking it was a mean advantage. Many of the Ibex broke through, but several were shot as they took refuge in the rocks, where the Baltis seemed to be almost as much at home on bad ground as the goats!

One buck stood looking over a cliff with his head over the edge below, but at some distance away dogs were barking furiously. Walking below and looking upwards it was a pretty sight, but to shoot at the poor beast was not to be thought of. Eventually that Ibex managed to get away.

Nearly all those shot were females or very small males.

To see much of the drive was impossible. Basgo is a big nullah, much shooting was to be heard, and now and again a few Ibex and several dogs passed.

Time makes changes. When the Game Preservation Department was started Basgo became a sanctuary, and efforts were made to stop the Ibex drives for if these come off in the snow, the results were fatal to the game. On the next day another drive was undertaken elsewhere, but luckily the game got through the stops, and only left two or three behind which were probably slain.

The impression left was that Game Preservation was urgent, sporting weapons were being steadily improved, and soon accurate rifles would supersede the smooth bore, and these combined with the aid of dogs and snow would exterminate the hill animals.

No. 349. MARKHOR (*Capra falconeri.*)

The *Markhor* of Kashmir.

The two varieties of this grand goat which exist within the limits of the territory dealt with in these articles are familiarly known as

1. The Astor (*Capra falconeri falconeri*) with a bold single twist which gives a massive appearance.

2. The Pir Panjal or Kajnag (*Capra falconeri cashmiriensis*) with 2 to 2½ spirals.

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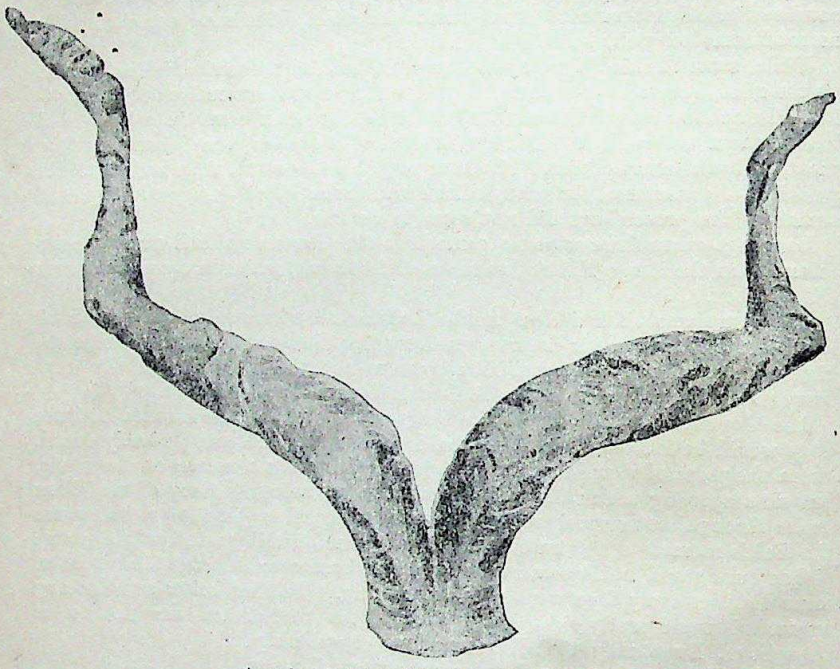
Some of the Kajnag heads vary and almost approach the other variety in the curves.

There is a third or Trans-Indus variety (*Capra falconeri jerdoni*) with 4 or more twists, but this is not an appropriate name, for the "Astor" is also a Trans-Indus animal; the term Sulieman Markhor is a better one. There is also a Cabul Markhor (*Capra falconeri megaceros*). The Pir Panjal and Astor horns are generally measured round the curves, the Suleiman which have many twists are taped straight.

The list of horns is not a long one, for very few big heads are secured, but doubtless several between 50 to 52 inches have not been recorded.



A pair of Astor Markhor Horns.
Length 53" (much weatner worn and rather uneven).

Measurements of Astor Markhor horns from Baltistan (Astor) and Gilgit.

Index No.	Length	Girth	Tip to Tip	Name of Sportsman	Date	Locality, &c.
1	61¼	12	47	Capt. Barstow	1907	Gupi's, Gilgit.
2	57	11¼	37	Capt. Molesworth	1916	Gilgit.
3	56¼	10¾	37	W. P. Appleford	1910	,,
4	55	..	..	Capt. Haughton	1911	,,
5	55¼	11	38¾	Capt. Selous	1906	Astor.
6	52	11	40	A. E. Ward	1887	Gilgit.

Above Dumoot in the Gilgit District amongst a pile of old horns, a much worn single one was found, this was carefully measured as 61 inches, and was

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brought to Boonji, where many people must have seen it. Another single horn of 63 inches has been recorded.

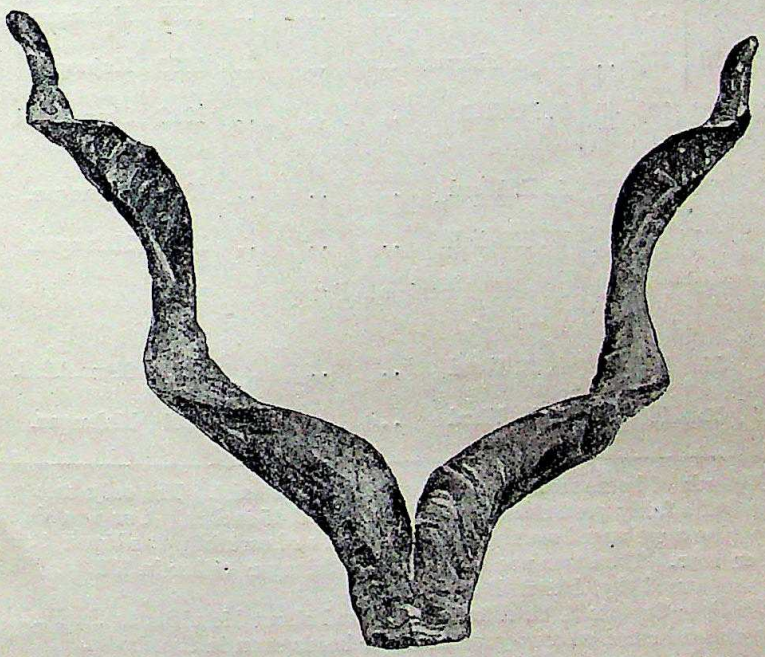
Having spotted a fine buck, the only thing to do is to follow it day after day and give up all idea of shooting inferior animals, until the big head is brought to bag or all trace of the animal has been lost,—try patiently.

Luck does not always hold good, and this was the case in a very unlucky trip during which a big Markhor was followed for several days. The continual change of wind was fatal, and eventually the beast vanished. Another fine Markhor had been found higher up the nullah where stalking was easier. The shot was taken from a cliff with the buck below, as it was browsing with head slightly downwards, the bullet went through a horn and the core and then smashed the skull below the second horn. The undamaged horn measured 52 inches.

There are the grandest views in the country above Dumoot, this valley is also the field naturalist's paradise, for here rare birds breed, and numbers of rodents live. Now all the country is closed to the visitor. Elsewhere there are many places where field research can be carried out, but very few places where the big-horned Ibex and Markhor can be shot.

The sketches which were made from photographs represent horns from Astor and the Kajnag, and are of about the same size, *i.e.*, measurements.

PIR PANJAL OR KAJNAG MARKHOR (*C. falconeri cashmiriensis.*)



A pair of Horns from Kajnag. Length a little over 53".

The horns of this variety are often very long and vary greatly in curvature. As a rule they do not girth as much as those from Gilgit and Baltistan.

The Kajnag and Shamshibri are now under the careful supervision of the Game Preservation Department from whom copies of the rules in force can be obtained.

The Kajnag which is adjacent to the Vale of Kashmir and close to the main road was overshot in the eighties. There are apparently very few good heads left. However, when Malangan in the Kajnag is re-opened for sport, the big bucks may again be found.

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Measurements of Markhor Horns from Kajnag.

Index No.	Measurements			Name of Sportsman	Date	Locality, &c.
	Length	Girth	Tip to Tip			
1	59	10¾	36	Col. S. Turnbull..	1903	Kajnag.
2	59	10½	..	Major Sherves	1888	Malangan, Kajnag
3	58	10¾	41¼	Major Knox	1909	Kajnag.
4	57½	10	39½	H. McLaughlin	1907	Kajnag(Malangan)
5	56	..	..	W. Mitchell	1888	Malangan.
6	56	10½	..	Major Sherves	1888	Kajnag.
7	55½	10½	40	P. M. Hall	1916	Shamshibri. †
8	53½	10½	32	A. E. Ward	1881	Malangan.
9	52½	..	..	W. Mitchell	1888	Malangan.
10	52	..	..	Offered for sale at Rampur in a shop.	1880	
11	51	10½	..	A. E. Ward	1887	Shamshibri.
12	50	10	..	A. E. Ward	1881	Malangan.

Records of horns from the Pir Panjal* do not exist. The only two pairs of horns of a fairly good size known of, measured 45 inches. One was shot long ago after a prolonged search for a good head, and certainly was bigger than any other seen. The other was brought in to Srinagar either in 1886 or 1887 and was measured by Henri Dauvergne.

The late Captain S. G. Allan often talked about his visits to the Pir Panjal, but stated he had seen no good Markhor heads even in the sixties.

A few but very few big bucks are to be found in Poonch and are protected by the Rajah. So let a return be made to the Kajnag. Accompanied by a friend a move was made to the ground opposite to Rampur on the old Abbottabad route. Report had told of many big bucks high up in the Malangan cliffs, and in other rocky mountains.

†(Note—Shamshibri Ranges are next to the Kajnag.)

* In Rowland Ward's Records of Big Game the largest head from the Pir Panjal measures 53″ (Maj. F. W. Walshe); other good heads from this area are 51⅜″ (Sir Edmund Loder) and 48½″ (Mr. J. G. Millais).

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The autumn was coming on, the mists had cleared off, the fresh morning air was delightful and hope was in the ascendant. A well known old shikari who was lame, but who could get over any bad ground met the camp and gave his news.

"One big buck quite close and three a little further off!" His idea of close was probably 10 miles and five thousand feet up the mountain, the little further off "turned out to mean a very long day's climb, and then two or three hours amongst almost vertical cliffs."

The single buck was found and bagged by the camp companion, the term "big" was an exaggeration, still the horns were well over 45 inches.

Before daylight on the second morning after a very long tramp on the previous day the camp was on the alert. A few sticks were lighted and charcoal made for the samavars; hot tea is an excellent beverage at early dawn.

The start was made as soon as it was possible to see the exact place to tread, for the rocks although not very difficult, were rather friable and unsafe.

High up under the main cliffs there is an open slope of some size, where grass and stunted birch grow, and where young birch bushes are crushed down by the snow and lie in tangled heaps. The slope can only be approached from one side. For some distance above the approachable side, the ground was broken up by rocks. It was there the three bucks were found. The lame old shikari "Rahmana" has now passed away, but he was generally very reliable and on this occasion absolutely so. One buck was standing up close to a lot of birch, the other two were resting on an open part of the slope.

By crawling and dodging from cover to cover not more than 80 yards intervened between the rifle and the standing buck. It seemed to be almost impossible to miss, but the buck did not appear to even flinch but stood still—on receiving the second bullet he subsided on to his side. Both bullets had hit behind the shoulder, the first had probably struck some nerve centre.

Naturally the other two Markhor were off at once, but owing to the nature of the ground they had to come broadside on and slightly above. This gave time to get hold of the second rifle, and drop the leading animal which fell dead and rolled into the dried birch.

The third buck was still within shooting range but whether hit or not it is difficult to say and before there was time to reload he was out of sight. The shikari rushed forward and trod on a spike of birch wood which penetrated his grass shoe deep into the instep.

By means of forceps which were in a roll of taxidermist tools the spike was pulled out, cotton wool and a bandage made the lame man fairly comfortable and when this was finished, Ramana began to talk. He would have it the third buck was hit, and could not get away.

Leaving the old man to take off the heads and skins of the slain the living buck was followed. The rocks were bad going from the first and after a short distance quite impossible, but the buck had gone on until he had reached a ledge, and there he stood, possibly over 300 yards away. He had crossed with his right side towards the rifle, but now as he turned round, his left side was exposed, but the glasses showed no wound which if it existed was probably in the middle of his body, for his legs were intact.

The shot was too long for a rifle only sighted up to 200 yards, and the result of firing all but two or three cartridges only ended in hard smacks against the rocks, so leaving the coolie, who seemed reasonably acute, to watch, a return was made to help the doubly lamed Rahmana. It was intended to return the next morning and to expend more cartridges, for when the coolie reached the temporary camp, where the night was spent, he said the buck was still there. In the morning he was not to be seen, and both men declared that he must have fallen over. Some days afterwards broken pieces of one horn, and a damaged

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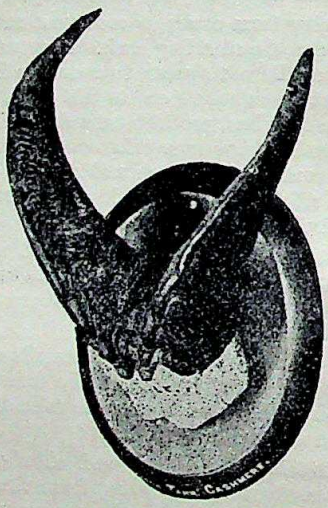
head with half a second horn were brought into camp. The chances are this was the last of the three big bucks that were "a little further off," but who knows what tricks may have been played by the shikaris.

On another occasion three shootable Markhor and two small ones were said to be in a ravine not far from camp. This was years later. One head of 51 inches was obtained and the rest left, for Markhor were scarcer than in 1881.

Old Ramana was still going and came on the trip. His foot had healed at once, still it was probable he had experienced a great deal of pain, which he bore without a murmur. No account of Markhor shooting would be complete without mentioning 'Kennard,' who wintered in Baltistan and shot many Ibex and Markhor. A number of the Markhor were got on the Indus or rather just above the cliffs. Amongst the heads were some fine massive wide spreading specimens, but the measurements are not just now available. The late Mr. Kennard probably shot more of the Hill Goats than any other European; for he had the cream of the sport in the days when firearms of precision were scarce on the frontier. He also shot in the winter season, for there were no game laws, few men thought of the future and the legion of sportsmen who now come to Kashmir. Two hundred was then the limit of the number of visitors who could visit Kashmir. Many of these two hundred never went outside the boundary of the Vale or even to the Wardwan and Soroo and it was often possible to shoot over the greater part of Ladak and Baltistan without meeting more than two or three other sportsmen.

No. 350. The Tahr (*Hemitragus jemlaicus.*)



Horns of Tahr (*H. jemlaicus*) 13½" (From the Society's collection)

The *Kras* or *Jagla* of Kashmir.

The *Kart* in the country bordering on Chamba.

The *Jhula* of the United Province hills, but this name is generally used to designate the old males.

The Pir Panjal, Kishtwar-Dachan and the lower Wardwan hold many tahr. On page 509 in the volume on Mammals (Fauna of British India Series) there is a drawing of this thick set goat which however is very active in the precipice.

The trophy is a poor one, unless set up with the long hair of the neck. The Thar is an evil smelling beast, but one that gives grand sport to those who love scrambling amongst the rocky forests, where deodars grow, and where pheasants can be met with.

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Index No.	Measurements: Length	Measurements: Girth	Measurements: Tip to Tip	Name of Sportsman	Date	Locality, &c.
1	14¾	9	8	Capt. I. M. Cameron	1906	
2	14¾	7¾	6	H. D. Anderson ..	1914	
3	14⅝	..	..	Capt. Dennys ..	1911	
4	14½	..	..	Capt. Finlay ..	1910	
5	14½	9¼	6⅛	Capt. Lewis ..	1904	
6	14½	9	7½	Capt. Stockwell ..	1908	
7	14⅛	8½	6	Capt. H. Percy ..	1904	
8	14	9	5½	Major Drew ..	1907	
9	14	8½	..	P. F. Hadow ..	1908	
10	14	..	..	Capt. Sturges ..	1921	

It is refreshing to be able to enter on the list of horns one of 14 inches shot in 1921. A very large number of heads 12 inches to 14 inches could be entered. Except for those who are keen on records there is a satisfaction in shooting any old Thar with a head over 12 inches, and many such are to be found.

In former years when Kishtwar, which is attached to the Jammu province, was closed to the public, very few good heads were to be got. The lower Wardwan and the Pir range held little worth shooting, but one head of over 13½ inches can be brought to mind, and that was shot in the Gwee-nye in the Wardwan Hills.

A Collector's Trip on the Borders of Kishtwar and Thar Shooting.

Not far from where the Panjari-dar Mountain marks the boundary, a comfortable camp was pitched amongst fine horse chestnuts and deodars, the object in view being to collect various small beasts and birds, and if luck was good a brown bear or in fact anything that presented itself.

An expert in skinning was included in the following, for it is tiring work to be out early and inspect the many traps, then go out after birds and come back to skin and label them.

On arrival, it was decided to halt and sort out what might be required; there were no villages, the sheep were not as yet on their grazing grounds, and by luck no one was about.

During the halt, hours were spent in trying to find where the Speckled Wood pigeon made their nests. A pair of Bonelli's Eagles were located in some rocks, which chased a Monal pheasant which was put up, but they failed as the quarry dropped suddenly and took shelter in the forest. A brown bear and also a Serow were seen, the latter being put up by the sound of the collector's

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gun, and disappearing before a rifle could be handled. The bear was left alone as it was a female.

Marching on the next day through the forest of mixed trees was very pleasant, but nothing was seen until emerging from the trees a stream was reached and the sound of a waterfall heard.

Above the waterfall—there was no crossing below the fall—was a steep smooth slab of rock over which a wide stream of water flowed.

On the far side of this slippery and smooth rock a herd of Thar were feeding quite unconscious of danger, whilst beyond them and above them were broken up cliffs. Between the forest and the stream there was sufficient scrub to cover the stalker, but the distance from the edge of the water to where the Thar were feeding was too far for a certain shot. Sitting amongst the bushes and watching was pleasant enough only for a short time, but this had to be endured or the idea of getting those Thar had to be given up. After a long wait the animals came towards the water, it seemed to be impossible that they could get a footing on the smooth slope. Anyway three bucks came to the edge of the water and the leading one was not more than 50 yards away when he was shot, and fell forward into the water and in a second was at once swept downwards. A second buck hard hit, went upwards and then lay down perhaps two hundred yards away. Nothing definite could be seen, and several shots were necessary before he rolled out of the rocks on to fairly level ground below, and lay dead.

The Kishtwaris are Hindus, so no throat cutting operations were necessary. A coolie was left to try and scare off vultures, whilst the rest of the party descended the ravine to look for the first Thar that had fallen. Below where the smooth rock ended was a mass of snow. Adjacent to the rock it had been melted by the water, leaving an open space and, in this, between rock and snow, the body of the Thar was fixed. Evidently time would be required to get it out, so crossing on the snow, a return was made and the second Thar was picked up and sent into the main valley below. Without appliances there was no getting at the first Thar and it was not until a pole had been placed across the chasm and the guy ropes of the tents used, that a man could descend and fasten the ropes round the body, which could then be hauled up; but this work had to be deferred until the next morning when a bedraggled mass of hair and goat was extracted.

The snow slide was a boon, for it not only formed a bridge over the side stream where the Thar were found, but also over the main water of the valley, for the junction of the two waters was close at hand. During various trips on three occasions animals have fallen into crevasses or into the water below snow bridges; twice Thar which were got out dead, but the third time a bear which unfortunately was wounded had to be left, poor beast!

There was plenty to do in camp for a day or two, and a fresh start was to have been made on the morning of the third day but the post coolie reported he had seen a solitary Thar down the valley.

The road, or rather cattle track which followed the small river was taken, then a halt was made and the glass got out, after along scrutiny the Thar was seen lying down under a deodar tree.

To suit the wind the stalk had to be upwards. When almost within shootable distance the accommodating animal got up and crossed the narrow nullah immediately above. A long shot was taken, and the Thar fell, rolling down the steep incline to within a few yards of where we stood. The distance probably was over estimated for the bullet hit high up where the neck joined the body. The skin was given to the postal runner, as he explained that Thar skins, when cut into strips, were used to fasten the yoke of the ploughs on the cattle as caste forbade the hides of cows being touched.

Three Thar heads were sufficient. As the five mountains (Panjendar) were only about 8 or 10 miles further up, the camp was taken on—what a difference there

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is between the preserved Deodar Forests, and the unprotected birch. The black dead stems of the birch were a dismal sight. The cattle and goat herds had stripped off the small boughs of the birch and consequently the trees were ruined. Maple and horse chestnut trees were cut to pieces and were monuments of destruction standing stark and drear in the snow.

This devastation is going on almost everywhere and has ruined many and many a fine Forest.

A return was made by another valley. Thar were seen and left alone. A goral and a bear were shot. This ended a very pleasant trip and a most successful result from a field naturalist's point of view, for the upper valleys of Kishtwar hold many birds that are seldom to be seen in Kashmir. The views of the mountain peaks of Brahma are very grand—the people are interesting and talkative.

(To be continued)

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INDIAN DRAGONFLIES.

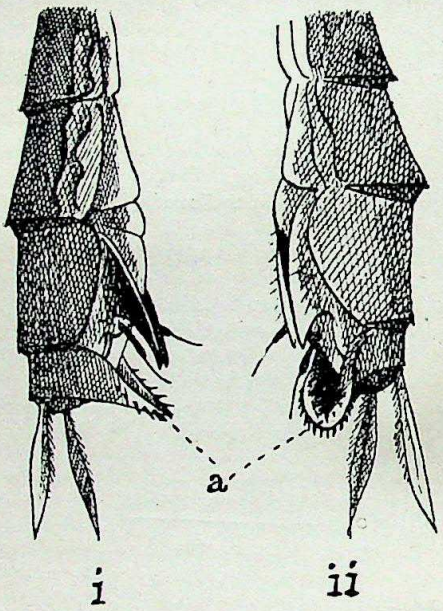
BY

MAJOR F. C. FRASER, I.M.S., F.E.S.

PART XIII.

(*Continued from page 492 of this Volume.*)

(*With 5 Text-figures.*)



* Fig. 1. i. Terminal segments of abdomen of *Æschna erythromelas* showing (*a*) dentigerous plate. ii. The same of *Æschna ornithocephala*.

Group—BRACHYTRON.

The genera included in this group are characterized by the symmetrical forking of *Rs* (5th nervure) and by the presence of only a single row of cells between *Rs* and *Rspl* (5th nervure and 5*a*) and between *Miv* and *Mspl* (7th nervure and 7*a*). (An exception is *Jagoria* in which *Rs* is unforked.)

The eyes are generally smaller and less contiguous than in group *Anax*; the frons usually broad or very broad, the occiput small and simple. The wings are long and broad or narrow, the reticulation open or close, the base of the hindwing usually excavate and angulated in the male, rounded in the female, the stigma variable, long and narrow or short and broad.

The dentigerous plate of the female is variable, subrotundate, denticulate or forked. The anal superior appendages of the male usually lanceolate, the inferior subtriangular.

* This figure was omitted from the previous part and should have been included under the description of *Æschna erythromelas*. Vol. XXVIII, No. 2, p. 490,

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Genus—JAGORIA.

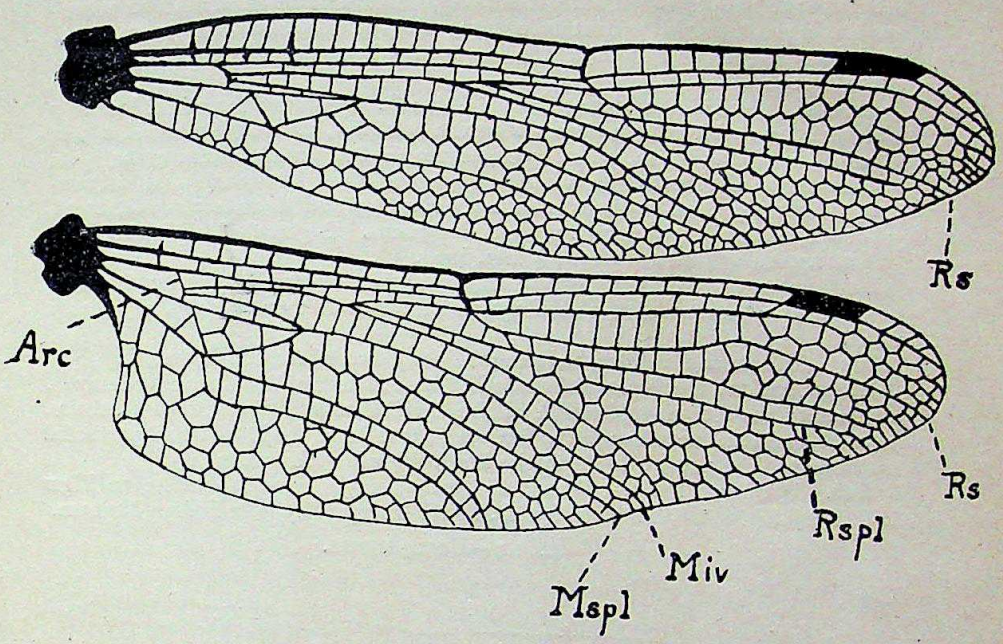

Fig. 2. Wings of *Jagoria pœciloptera*, Karsch. ♀ (x 2·5).

Jagoria, Karsch, Ent. Nachr., xv., p. 238, (1889); Laidlaw, Rec. Ind. Mus., Vol. xxii, p. 76, (1921); Martin, Cat. Coll. Selys, *Æschnines* p. 155, (1908).

Head moderately large; eyes large, broadly or moderately contiguous. Wings moderately long and broad, reticulation moderately open, trigones short, with 3-5 cells, basal space (prearcular) entire, 2 cubital nervures in all wings, hypertrigones entire or traversed by 1-2 nervures, *Rs* not bifurcated, only 1 row of cells between *Rs* and *Rspl*, 1-2 rows between *Miv* and *Mspl*, membrane short and narrow, not usually extending along the whole length of the wing—base, stigma braced, moderately short and thick, anal triangle of 3 cells, anal border moderately excavate.

Legs long and rather slender. Thorax robust.

Abdomen cylindrical, only slightly tumid at the base, constricted at the 3rd segment, widening again from 4 to 6 and then narrow and cylindrical as far as the anal end. Superior anal appendages longer than the 10th abdominal segment, variable in shape, the inferior more or less cylindrical, long and bifid, rather more than half the length of the superior.

The 10th abdominal segment in the female prolonged into a finely denticulate plate below. Anal appendages of female long and foliate.

Jagoria martini, Laid., Rec. Ind. Mus., Vol. xxii, p. 76-77, (1921).

Female only known. Length of abdomen 40 mm. Hindwing 40 mm.

Head. Labium, labrum and epistome orange brown, the upper surface of frons marked with a broad "T" shaped mark, brown in front and black against the eyes, frons yellowish, vesicle and occiput black, the latter fringed with a tuft of black hairs.

Prothorax dark brown.

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Thorax dark brown marked with a pair of oblong, oval, bluish green, antehumeral bands which converge above but do not quite meet the mid-dorsal carina. From near the upper end of these bands, a pair of similar coloured, short, narrow bands run towards the humeral suture. On the sides two vivid green, broad bands, one at the middle and the other covering the entire metepimeron. Beneath orange brown.

Abdomen black above, orange brown beneath. Segment 1 marked laterally with vivid, greenish yellow, segment 2 with a lateral, yellow band and a pair of small, semilunar, green, apical spots, segments 4 to 6 with similar green spots but smaller on the latter. In addition segments 2 to 4 have each a pair of narrow, transverse, green marks at about their centre and there is a small, basal, yellowish green, triangular mark on the 2nd segment. Segments 7 to 10 unmarked.

Anal appendages small, about 2 mm. long.

Dentigerous plate on the 10th abdominal segment almost squarely truncate posteriorly and is furnished at the apex with about 15 small, irregularly placed teeth.

Legs black, coxae and trochanters and the bases of femora brownish.

Wings hyaline, the bases saffronated as far out as the 1st antenodal nervure, trigones of the forewings 3-celled, of the hind 4-celled, hypertrigones entire, 16 to 17 antenodal nervures to the forewings, 9 to 11 in the hind, 7 to 8 postnodal nervures to forewings, 8 to 10 in the hind, stigma dark brown.

Hab. Darjiling District. Described from a single specimen taken on Tiger Hill, Darjiling, 8,300,' 26-vi-18 by Mr. S. W. Kemp. Type in Indian Museum.

Genus—PERIÆSCHNA.

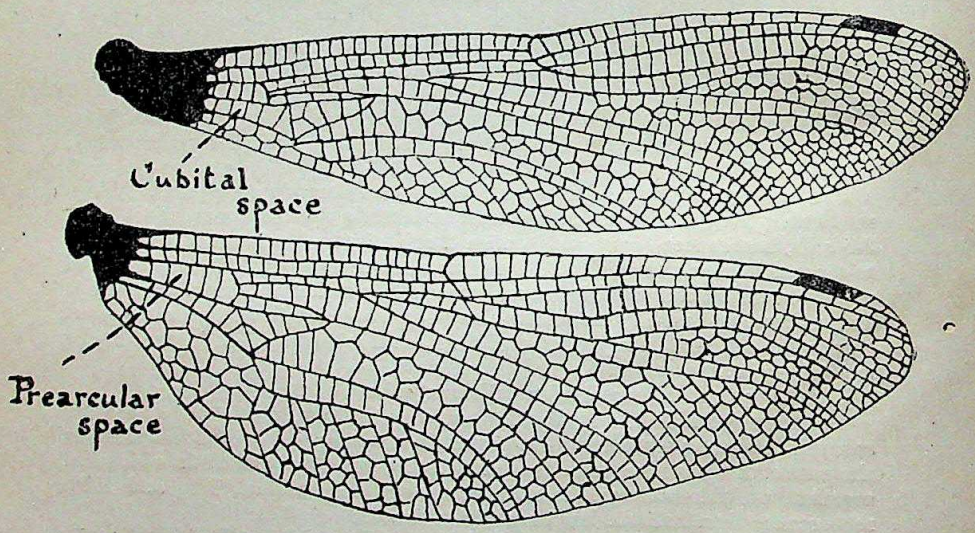

Fig. 3. Wings of *Periæschna magdalena*, Martin. ♀ (x 2·5).

Periæschna, Martin Cat. Coll. Selys, *Æschnines*, xix, xx, p. 157, (1908) Laidlaw, Rec. Ind. Mus. Vol. xxii, p. 81 (1921).

Female. Head globular; eyes broadly contiguous; occiput small.

Wings broad, a little rounded at the apices, reticulation open, trigones, elongated, of 5 to 6 cells, prearcular and cubital spaces and hypertrigones traversed, the latter 3 times, *Rs* bifurcated nearer the node than the stigma or at

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least halfway between these two structures, *Rspl* running parallel to *Rs* and only 1 row of cells between them, stigma moderately short and stout, membrane moderately short and narrow.

Legs short and robust. Abdomen slender. Anal appendages short and slender. Dentigerous plate forked with fine, needle-like branches resembling those found in *Gynacantha*.

Periæschna magdalena, Martin, Cat. Coll. Selys, *Æschnines*, xix, xx, p. 157, pl. vi, fig. 22; Laidlaw, Rec. Ind. Mus. Vol. xxii, p. 81, (1921).

Female. Abdomen 67 mm. Hindwing 44 mm.

Head. Labrum, labium, face and frons reddish brown, the base of the latter black with a medial prolongation forward.

Prothorax and thorax blackish brown marked with a narrow, yellow, antehumeral stripe on each side and 2 broad, yellow stripes laterally.

Legs blackish brown, reddish at the bases.

Abdomen tumid at the base, slightly constricted at the 3rd segment, and thereafter cylindrical as far as the anal end. Ground colour black marked with yellow as follows:—segments 1 and 2 with the sides broadly yellow and the dorsal carina finely, the 3rd segment with a basal, lateral spot, segments 4 to 7 with similar but less evident spots, segments 8 to 10 unmarked.

Superior anal appendages fine and short, but slightly longer than the 10th segment which is very short.

Wings enfumed, costa dark brown, stigma reddish, short and stout. All wings have a basal brown marking which extends outwards as far as the 1st antenodal nervure; membrane white.

Type female in Martin's collection Tonkin, Assam. Dr. Laidlaw reports a pair from Tura, Garo Hills, Assam, which are now in the Indian Museum.

Genus—AUSTROÆSCHNA.

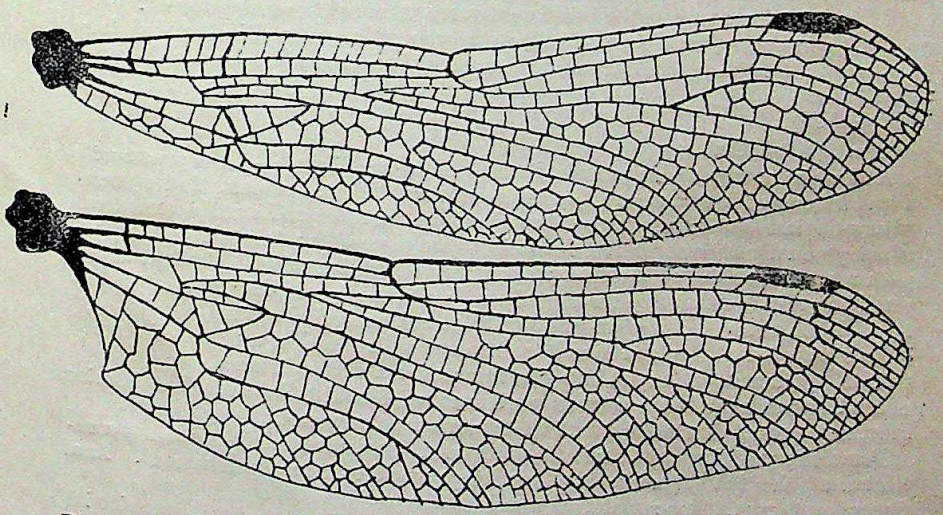

Fig. 4. Wings of *Austroæschna intersedens*, Selys. (x 2·5).

Austroaeschna, Selys, Bull. Acad, Belg. Vol. 3. p. 732, (1883).
Acanthæschna, Selys, ibid. p. 731, (1883).
Planæschna, Maclachlan, Ann. Mag. Nat. Hist.), Vol. 27 (1895).
Dromæschna, Forster, Ann. Soc. Ent. Belg.), Vol. 52 (1908).
Austroæschna, Martin, Cat. Coll. Selys.), Vol. xix, xx (1908).

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Eyes slightly contiguous; occiput small; frons narrow as viewed from above; face narrow, subglobular, fringed around with long hairs.

Abdomen slender, tumid at the base, constricted markedly at the 3rd segment and from thence cylindrical till the end. Anal superior appendages long and slender, much longer than the 10th segment, inferior narrow and truncate, triangular. The dorsum of the 10th segment with a prominent carina. Oreillets robust.

Wings moderately narrow, reticulation rather close; trigones short, of 2 to 4 cells; prearcular space entire; cubital space and hypertrigones traversed; *Rs* bifurcated well before the stigma; only a single row of cells between *Rs* and *Rspl* and between *Miv* and *Mspl*; anal border markedly notched; anal triangle of 3 cells; membrane short and slender, not quite the length of the anal border.

Superior appendages long and slender, longer than the 10th segment; inferior short, truncate, triangular. Dentigerous plate of female subrounded, finely denticulate. Appendages short.

Hab. Australia. Represented by a single species within Indian limits.

Austroæschna intersedens, Martin, l. c. p. 101, pl. iv., fig. 14.; Laidlaw, Rec. Ind. Mus., Vol. xxii, p. 79, (1921).

Male. Abdomen 40 mm. Hindwing 37 mm.

Head. Eyes green, moderately contiguous; labium olivaceous; labrum, face and frons bright yellow, the latter which is raised into a fine point at its centre, smoky brown along the crest. The crest and borders of the face fringed with a ruff of long, black hairs.

Prothorax brown.

Thorax maroon brown marked with bright yellow as follows:—2 antehumeral stripes on the front of dorsum, separated by the dorsal carina and lying parallel to one another, the interalar sinus, tergum and some small spots at the bases of the wings. Laterally two broad stripes, one of which lies between the humeral and first lateral suture and the other covers the whole of the metepimeron.

Wings hyaline, stigma black, 3 cells in trigone of forewing, 4 in the hind, loop very small, of 4 cells, 4 cubital cells in forewing, 4 to 5 in the hind; nodal index:—$\frac{12\text{–}18}{13\text{–}11}$ $\frac{17\text{–}13}{11\text{–}12}$; I row of cells between *Rs* and *Rspl*; 2 rows of cells between the bifurcation of *Rs*.

Abdomen brownish black marked with yellow as follows:—1st segment with a quadrate spot low down on the sides and a middorsal streak, 2nd segment with an apical, subtriangular spot low down on the sides and a middorsal streak which gradually tapers apically, the oreillets are also yellow, 3rd to 10th segments with a continuation of the fine, middorsal yellow line which broadens into a small triangle on either side the dorsal carina about the middle of the segments. In addition, there are on segments 3 to 9 lateral, subapical spots.

Legs dark brown, the coxae and trochanters yellow and at the base of the mid pair this yellow is prolonged into the thorax for a short distance.

Anal appendages long, sinuous and narrow, blackish brown. The inferior long, not quite half the length of the superior, narrow and triangular.

Female very similar to the male, the abdomen being stouter at the base, not constricted at the 3rd segment, the markings rather more pronounced. Anal appendages small, lanceolate, pointed.

Dentigerous plate simple, prolonged into a spout-like structure, armed with about 8 small spines.

Hab. Assam, Cherrapunji and Shillong.

Genus—CEPHALÆSCHNA.

Cephalæschna, Selys, Bull. Acad. Belg., (3), v., p. 739, (1883).

Caliæschna, Selys, et Martin, Cat. Coll. Selys, *Æschnines*, xix, xx (1908).

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Cephalæschna, Laid., Rec. Ind. Mus., Vol. xxii, pp. 77-79, (1921).

Eyes broadly contiguous; frons raised in front or projecting markedly; occiput small, its hinder border slightly raised.

Thorax short, robust.

Abdomen long and slender in the male, stout and robust in the female. Slightly tumid at the base in the male and slightly constricted at the third segment, the 10th segment with a prominent middorsal carina. Oreillets of male prominent, the posterior border armed with 5 to 6 robust spines.

Anal appendages nearly as long as the 9th and 10th segments, slender at the base, broadening inwardly after the first third, with a prominent mid-rib, pointed at the apex.

Wings hyaline or enfumed; stigma markedly short usually braced; trigones with 3 to 5 cells; hypertrigones traversed three times; are strongly angulated; arcular space traversed usually 5 times; *Rs* forked, 2 rows of cells between the fork; loop with 5 to 8 cells, rather small, and stunted; a basal antenodal nervure of the first series always present and continuous with the first traversing nervure of the basal (arcular) space; base of hindwing in the male obtusely angular; rounded in the female; anal triangle with 3 cells; *Rspl* and *Mspl* running parallel with *Rs* and *Miv* respectively and enclosing 1 or rarely 2 rows of cells especially near the margin of the wing; antenodal and postnodal nervures numerous.

Legs long and rather slim; hind femora with a row of closely-set, robust, short spines and 2 or 3 longer ones at the distal end; tibial spines long and numerous: claw-hooks robust, situated nearer the base than apex, at which point the claws rapidly taper.

Dentigerous plate of the female rounded and subdenticulate.

Cephalæschna acutifrons, Martin, l. c., Ris. Supp. Ent., No. 5, pp. 55-56, tab. 2, fig. 5, (1916); Laid. l. c. (1921).

Female. (Male unknown.) Length of abdomen 52 mm., of hindwing 47 mm.

Face and frons olivaceous yellow, no markings above the frons which projects in front somewhat like the bows of a ship.

Thorax dark brown with a humeral stripe of bright green on each side and two lateral stripes of yellow bordered with vivid green.

Legs reddish yellow.

Wings broad, especially the hind, hyaline but saffronated at the bases; stigma small, reddish brown; costa orange; 25 antenodal nervures and 21 postnodals in the forewing, 19 antenodal and 24 postnodal nervures in the hind.

Abdomen broad and tumid at the base, the 2nd segment somewhat ovoid, the 3rd slightly constricted, dark brown marked with yellow as follows:—the 2nd segment with 2 small, linear, yellow spots at the centre and 2 others at the base, segments 3 to 9 have similar spots, the medial ones very small and linear, the basal larger and more semilunar in form.

Anal appendages very small, linear, dark brown.

Hab. Type female in the collection of Selys, labelled, India, is probably from Assam or Bengal.

Cephalæschna masoni, Martin, *Caliæschna*, Cat. Coll. Selys, *Aeschnines*, fig. 104, Pl. 111, fig. 12, p.111; Laid. Rec. Ind. Mus., Vol. xxii, pp. 77-78, (1921).

Male. Length of abdomen 55 mm., of hindwing 41 mm.

Face yellowish, a fringe of hairs round its circumference, flattened; frons yellow bordered finely with black.

Thorax blackish brown marked with a humeral band of green in front on each side and two lateral bands of the same colour.

Wings rather broad, hyaline; stigma blackish brown, very short; membrane short, white; anal triangle of 5 cells; forking of *Rs* begins well before the stigma;

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21 antenodal nervures and 11 postnodals to the forewing, 15 antenodal and 16 postnodal nervures to the hind.

Abdomen long and slender, black, the 1st segment with reddish hair, the 2nd with a basal, dorsal, yellow triangle, 2 transverse, linear spots of the same colour on each side of the dorsal crest at the middle of the segment and at the apical end, segments 3 to 9 with a linear spot of yellow on each side of the dorsal carina about the middle of the segment and a larger semilunar spot at the apical end nearly confluent across the dorsal carina, 10 unspotted.

Superior anal appendages long, slender at the base, then broadening spatulate-wise after the first third, the apex rounded, brown. Inferior appendage half as long as the superior, triangular.

Female unknown. It is possible that *C. acutifrons* is the female of *C. masoni*. The venation differs rather widely but this character is so variable a factor that too much importance should not be given to it.

Type male in the Selysian collection. Assam.

Cephalæschna lugubris, Martin, 110, fig. 103, Syn. Cat. Coll. Selys. *Æschnines*, xix, xx (1908).
Cephalæschna sikkima, Selys, in. litt.
Cephalæschna lugubris, Laid., Rec. Ind. Mus., Vol. xxii, p. 78, (1921).

Male. Length of abdomen 48-51 mm., hindwing 41 mm.

Head. Labrum, labium and lower epistome yellow, upper epistome green, frons in front shiny black, above yellow bordered with black, frons raised and narrow; occiput small, black.

Thorax short, blackish brown, marked with a green antehumeral band on either side of the front and laterally with two broad, green bands.

Legs blackish brown, the bases of femora reddish.

Wings hyaline, tinted with brown; stigma very short; brown; membrane yellowish, trigones made up of 4 cells; anal triangle with 3 cells; 2 rows of cells between the forking of *Rs*; 21-25 antenodal nervures and 11 postnodals in the forewings, 18-19 antenodals and 13-15 postnodals in the hind.

Abdomen long and slender, slightly tumid at the base, a little constricted at the 3rd segment, black marked with green as follows:—the 1st segment with a central, yellow spot, the 2nd with a dorsal, green line broken at its middle, 2 linear transverse streaks at the centre of the segment, separated by the middorsal carina, and finally an apical, green annule, segments 3 to 8 with, similar, central, linear marks and apical ring, segments 9 and 10 unmarked, the latter with a prominent, middorsal crest.

Anal appendages brown, nearly as long as the combined length of the last two abdominal segments, very slender at the base, broadly spatulate after the first third, the apex with a small spine. Inferior appendage triangular, about two-thirds the length of the superiors.

Female. Very similar to the male but the abdomen shorter and stouter. The frons without the black stripe above, the face olivaceous green. The 10th abdominal segment very short above. Anal appendages short, very slender filiform and pointed at the apex, brown.

Types in the collections of Martin and Selys.

Hab. Sikkim.

Cephalæschna orbifrons, Selys, Bull. Acad. Belg., (3) v. p. 739 (1883) Martin, Cat. Coll. Selys, *Aeschnines*, xix, xx (1908); Laid. Rec. Ind. Mus., Vol. xxii, p. 78, (1921).

Male. Length of abdomen 45 mm., hindwing 40 mm.

Head: Labrum, labium, epistome and frons uniform olivaceous and quite unmarked; eyes dark olivaceous, broadly contiguous; occiput small, black.

Prothorax dark brown bordered finely with yellow.

Thorax short but robust, dark brown marked with apple green, an antehumeral

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streak on either side of the front, broad above, tapering anteriorly. Laterally two broad stripes of the same colour, the first a little interrupted above at its upper corner, the second covering the whole of the metepimeron and just separated from a small spot of green at the base of the hindwing.

Legs blackish brown, the coxae yellow, long and rather slim.

Wings hyaline, rather broad; stigma black, moderately short and usually braced, that of forewing distinctly larger than that of the hind; trigones very variable, that of forewing with 3 to 5 cells, that of the hind with 3 or 4 cells; loop with 5 cells; 2 rows of cells between the forking of *Rs*; 7 to 8 cubital nervures in the forewing, 6 in the hind; hypertrigones traversed 3 times in all wings; reticulation rather close; nodal index:— $\frac{11\text{-}18}{13\text{-}16}$ $\frac{17\text{-}11}{15\text{-}13}$; anal triangle with 3 cells, membrane small, white.

Abdomen long and slim, tumid at the base, constricted at the third segment, dark brown marked with green and yellow as follows:—1st segment broadly greenish yellow on the sides, a dorsal, green triangle at the base and an apical, oval spot of the same colour; 2nd segment with the sides broadly yellowish green and the dorsum with 2 transverse, wedge-shaped spots about the middle, separated by the dorsal crest, a basal irregular spot of green and an apical streak of the same colour on the dorsal carina which is united with an apical, yellow annule; 3rd segment with the basal half of the dorsal carina yellow and a lateral, basal triangle of yellow at its centre, 2 transverse, yellow spots; 4th to 7th segments with the same central, yellow, transverse spots and apical annules of yellow; 8th and 9th segments with only the apical annules; 10th segment with only a lateral, yellow spot.

Anal appendages dark brown, the superior with a prominent mid-rib, narrow at the base, broadening spatulatewise after the first third, the apex bevelled, pointed as seen in profile, the upper surface near the apical end furnished with long, stiff hairs, the inferior about two-thirds the length of the superior, triangular, curling upwards.

Female. Length of abdomen 47-49 mm., hindwing 40-42 mm.

Head: Labrum bright ochreous, rest of face, labium and frons olivaceous as in the male; occiput black. Face as in the male, is fringed with a margin of long, stiff, black hairs.

Rest of thorax and abdomen very much as for the male, the sides of the 2nd segment are less broadly yellow, the sides of the 3rd are more extensively so, reaching as far as the apex, this colour also extends along the sides of the 4th and 5th segments and there is a trace of it on the 6th and 7th, the sides of the 8th to 10th being broadly yellow.

The other markings are as in the male but more pronounced and distinct.

Wings hyaline tinted at the extreme base with pale amber or saffron. Trigone of forewings with 4 to 5 cells, 5 in the hind; loop with 4 to 5 cells; hypertrigones traversed 3 times in all wings; 5 to 6 cells in the anal triangle; nodal index:— $\frac{19\text{–}20}{14\text{–}16}$ $\frac{11\text{–}14}{13\text{–}15}$ $\frac{19\text{–}12}{15\text{–}16}$; a basal, antecostal of the second series in all wings. Membrane ashy, small.

Legs yellow, the joints black as also are the spines on femora and tibiæ.

Anal appendages extremely short, filiform, pointed at the apex, brown.

Dentigerous plate rounded and subdenticulate.

Hab. Bengal. Darjiling District. I am indebted to Mr. H. Stevens for the chance of examining a number of these insects. The male as far as I know has not yet been described. The co-type male is in my own collection. I find as a result of my examination that the venation of this species varies very widely and to a less extent, the same applies to the markings. From this I deduce that the number of species described by Martin will probably resolve

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themselves into only two species. The coloured illustrations given in the Cat. Coll. Selys both for the *Corduliinæ* and the *Æschninæ* are exceedingly fallacious and to take one instance only, *e.g.*, that of *Hemicordulia asiatica*, no one knowing the living insect would recognise it from the coloured illustration given in the work cited. It will be seen from the above descriptions that they will equally fit either *lugubris*, *acutifrons* or *orbifrons*, not conforming to any entirely. The descriptions have been made from Mr. H. Steven's specimens and as an alternative to giving them specific rank, I have placed them as *C. orbifrons*.

Genus—GYNACANTHÆSCHNA, gen. nov.

Gynacanthæschna, gen. nov.

Cephalœschna, Karsch, Ent. Nachr., xvii, No. 20, pp. 6-7, (1891); Laid., Rec. Ind. Mus., Vol. xxii, p. 78, (1921).

Similar to the last genus in most respects but the neuration differs somewhat as also does the dentigerous plate of the female.

Wings rather narrower, usually a little enfumed; stigma markedly short, usually unbraced (or it would be better to say that the brace has shifted outwards and meets the stigma distal to its inner, posterior corner), 2 to 3 nervures converge on the posterior border of the stigma especially in the female; trigones with 3 cells in the forewings, usually 4 in the hindwing, other points as for *Cephalœschna*.

Dentigerous plate of the female forking into two stout spines very similar to those seen in genus *Gynacantha*.

Gynacanthæschna sikkima, (Karsch.) l. c.

Caliœschna sikkima, Martin, Cat. Col. Selys, *Æschnines*, xix, xx (1908); MacLachlan, Ann. Mag Nat. Hist., (6) xvii, pp. 409–425 (1905).

Cephalœschna sikkima et *Cephalœschna sp.* Laid. Rec. Ind. Mus. Vol. xxii, pp. 77-81, (1921).

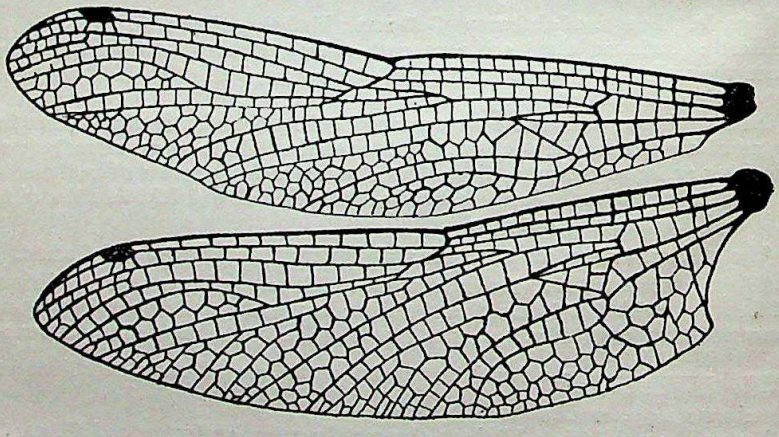

Fig. 5. Wings of *Gynacanthæschna sikkima*, Karsch, (x 2·3).

Male. Length of abdomen 46 mm., hindwing 40 mm.

Head. Labium, labrum, epistome and frons olivaceous brown, the lips somewhat more ochraceous; occiput black, small, fringed with black hairs; a fringe of longish, black hair also margins the front crest of the frons and is continued down on either side of the face; eyes broadly contiguous, olivaceous green.

Prothorax brown margined finely with yellow.

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Thorax short but robust, dark chestnut brown marked with green, the dorsum bearing apple green, antehumeral bands which taper slightly forwards, the sides entirely green except for a band of the ground colour at the middle which divides the green into a broad, anterior band and a broader, posterior covering the whole of the metepimeron.

Wings slightly and uniformly enfumed, long and rather narrow; stigma short, dark brown, over 3-4 cells in the forewing, only over 2 or 1½ in the hind, usually unbraced but a sloping nervure meets the stigma a little distal to its inner end, the stigma of the hindwing is much smaller than that of the fore; trigone of forewing traversed regularly 3 times, that of the hind 3 to 4 times and very irregularly, a nervure running from the base may join the first traversing nervure or run backwards to the outer side of the trigone, thus enclosing a triangular cell; membrane white; nodal index:—$\frac{10-18}{13-15}$ $\frac{19-10}{17-13}$; reticulation rather close.

Legs long and rather slim, the femora reddish brown except at the distal ends where they turn dark, tibiæ black, armature of the legs as for *Cephalæschna*.

Abdomen long and slim, tumid at the base, constricted at the 3rd segment, cylindrical thereafter, black marked with green and yellow as follows:—segment 1 broadly yellowish green at the sides, segment 2 also broadly yellow at the side, and the dorsum bearing an apical annule which is contiguous with a short, linear stripe on the dorsal carina, this stripe broken at the centre of the segment and here, on either side of the dorsal carina but not quite meeting it are 2 linear, transverse, yellow lines; segment 3 has an apical, narrow annule, 2 triangular, small, yellow spots situated nearer the base than apex and slightly separated by the dorsal carina, these spots are limited basally by the transverse ridge of the segment and low down on the sides at the end of this ridge is another small, yellow spot, finally at the base, on the sides is a largish, subtriangular spot; segments 4 to 7 have the apical annule and the two spots margining the transverse ridge; segments 8 and 9 have only the apical annule, whilst 10 has merely a small, lateral, yellow spot.

Anal appendages as long or nearly as long as the two last abdominal segments, slim at the base, broadening after the first third especially inward, traversed by a strong midrib, bevelled at the apex where they end in a small point, brown; inferior about two-thirds the length of the superior, curling strongly upwards, triangular.

Female. Length of abdomen 45 to 47 mm., hindwing 41 to 43 mm.

Very similar to the male in colouring but a much bulkier and stouter insect, the abdomen tumid at the base and not constricted at the third segment, rather flattened from side to side, the 8th and 9th segments broadened from above down.

Head. Labium and labrum bright ochreous, the rest of face and frons golden brown; eyes brown; occiput very small, black, with a crest of short black hairs.

Thorax as for the male, the antehumeral bands are of almost the same width throughout but are rapidly pointed at the anterior end.

Legs as for the male but the spines on the femora are more scanty.

Wings long and broader than those of the male, hyaline, the bases saffronated, this paling as far as the arc which is acutely bent; stigma only slightly smaller in the hindwing, the difference in size not nearly as marked as in the male, over 2 cells in all wings, braced but the brace not running from the extreme, proximal end of the stigma, dark brown; trigones with 4 cells in all wings; 7 cells in the loop; *Rs* forked a long way from the stigma, 2 rows of cells between the branches of the fork; nodal index:—Karsch's specimen $\frac{10-18}{12-15}$ $\frac{20-11}{16-13}$; Laidlaw's $\frac{9-19}{13-15}$ $\frac{19-12}{16-13}$; Stevens' $\frac{12-20}{15-15}$ $\frac{20-12}{16-14}$. (It will be seen that the combined number of ante and postnodal nervures in the forewings of the first two speci-

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mens comes to 31 for the right wings and 28 for the left whilst in both of the fore-wings of Stevens' specimen there are 32.) There is a basal antenodal of the 2nd series in all wings.

Abdomen black marked with green and yellow as follows :—1st segment with a small, dorsal streak of yellow and the sides broadly apple green ; 2nd segment marked as in the male but the sides more broadly and the basal half green turning gradually to yellow apically ; segments 3 to 7 have an apical, dorsal, yellow triangle formed by the confluence of 2 spots and a transverse, triangular spot on the transverse ridge. (This ridge has been named the "jugum" by Dr. Laidlaw), this spot also formed by the confluence of 2 spots ; segments 8 to 10 are broadly yellow on the sides.

Anal appendages very short and filiform, brown.

Dentigerous plate which has been figured in the preface to the subfamily, strongly forked into robust spines, directed downwards.

Hab. Type from Sikkim, in the Berlin Museum is a female. Laidlaw's specimen is also a female, from Cherrapunji, Assam, now in the Indian Museum. The male, which has not been described before is from Gopaldhara and I am indebted to Mr. H. Stevens for it. I have seen also a female collected by Mr. Inglis above Mangphu, 5,500'.

The differences between the descriptions of Karsch's *C. sikkima* and Laidlaw's *Cephalæschna sp.* are not greater than those between individual specimens collected by Mr. Stevens and Mr. Inglis so that I have no hesitation in treating them as one and the same species.

(*To be continued.*)

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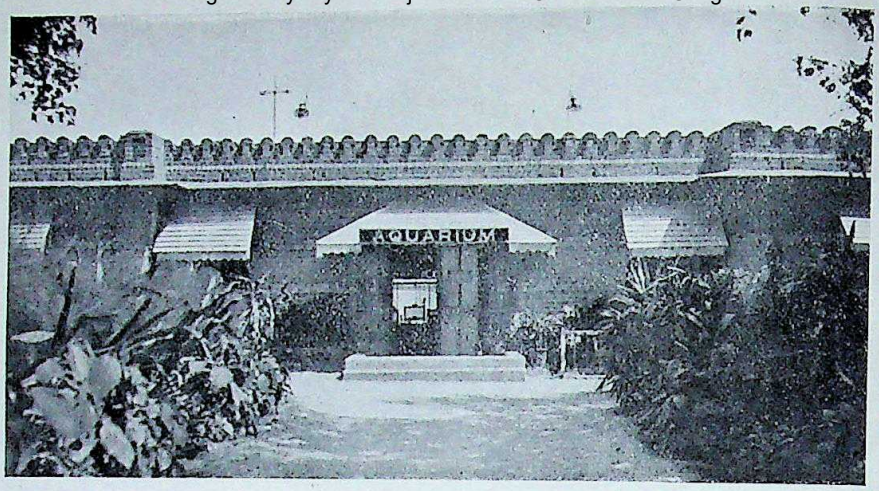

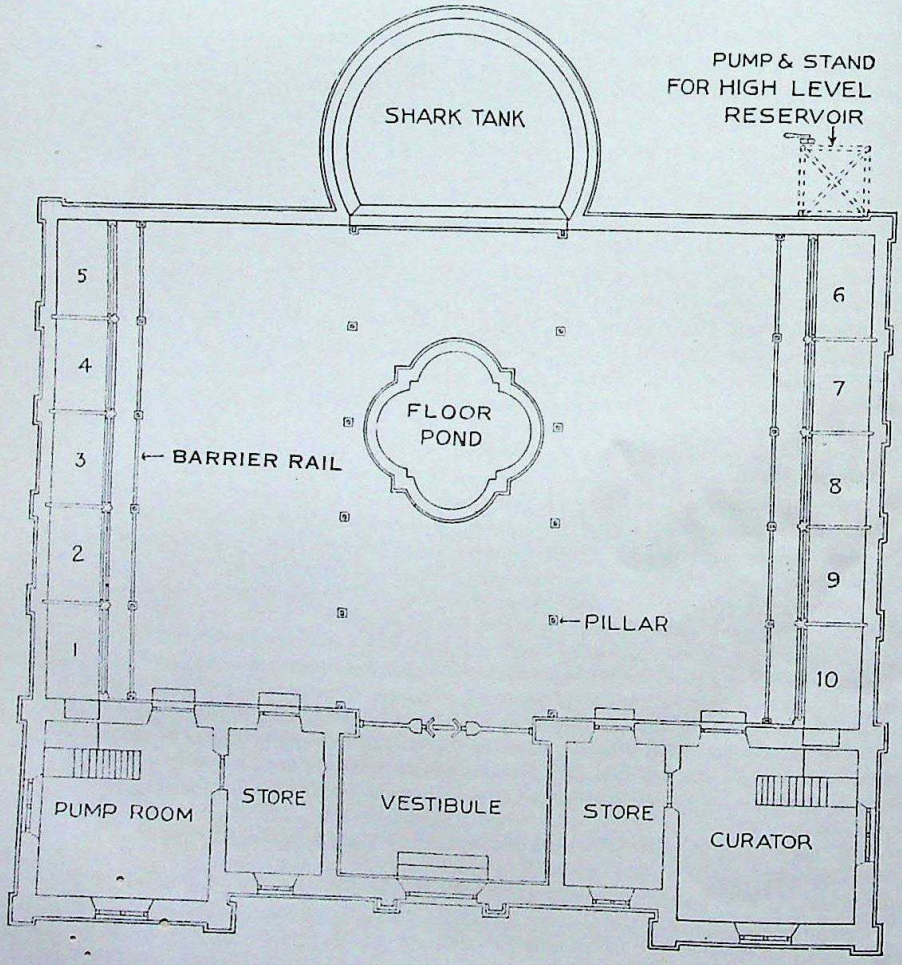

THE MADRAS AQUARIUM.
Exterior view and ground plan.

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THE MADRAS AQUARIUM.

BY

JAMES HORNELL, F.L.S., F.R.A.I.

(With a plate and 6 text figures.)

In spite of the fact that the Madras Aquarium was opened so long ago as 1909, and that it has proved a wonderful success whether judged by the public interest aroused or by the cold verdict of finance, it has had no imitators on the Asiatic mainland. Until the last few years its reputation had not travelled beyond the confines of Madras, for till that time no strong effort was made to advertise it and make its attractions widely known. The first enthusiasm aroused by its energetic and versatile creator, Mr. Edgar Thurston, the then Superintendent of the Museum, died down in large part when he retired, which unfortunately coincided with the completion of the building; only when it was transferred to the care of the Department of Fisheries was any systematic effort made to extend its usefulness, and develop its possibilities to the utmost.

To Mr. Thurston is due the credit for the inception of the scheme. As is well known he devoted an important section of his life's work to the investigation of the marine fauna of the Gulf of Mannar; his notes on this subject, all too few, are charmingly written and full of interesting observations of great value to naturalists following in his tracks. The idea of an aquarium, where some of the wonders of the coral reefs that fringe the southern shores of the Madras Presidency might be brought home to the multitudes of Madras, must surely have been born on one of these collecting expeditions. At their best, what are stuffed fishes, dried sponges, corals and crabs, and colourless and shrunken specimens in jars, but faded and unsatisfying mummified remains? To one familiar with the wonderful beauty of form and colour of the life of the shallower depths of our Indian seas, the desire to see these under conditions permitting close observation of habits such as is impossible in the sea itself, is always present; the designing of the Madras Aquarium was the outcome of this feeling in Mr. Thurston's case. Curiously enough, the writer, not then connected with Indian fishery development, happened to be in Madras at the time when the plans were being roughed out, and his remembrance of discussing with Mr. Thurston the details and arrangements of the tanks and fittings is vivid; apart from the interest of the subject, the personality of the designer was an arresting one, for Mr. Thurston had filled many roles in his career.

Funds were not available for a very extensive or elaborate building; simplicity and economy had to be studied, and both architect (Mr. Harris, Consulting Architect to Government) and contractors did wonderfully well to complete the building, virtually as it stands to-day, for the sum of Rs. 17,604; installation of electric lighting and fans subsequently cost an additional Rs. 4,778.

It is located on the sandy sea-beach, opposite the Presidency College, and midway between Fort St. George and San Thomé—between what were the original settlements of the English and the Portuguese at Madras. This long line of beach, bordered by a fine promenade, the 'Marina,' the pride of Madras, has broadened considerably since the construction of the harbour works owing to sand accretion due to the northerly drift of sand along the coast in this locality; it is this accretion that has permitted of the erection of a building on the seaward side of the roadway at the spot chosen as the site for the Aquarium. Principally for æsthetic reasons the design of the building had to be restricted to one floor; that too is sunk some four feet below the general ground level. Originally it was less, but year by year drifting sand continues to raise the ground level; increasing difficulty is experienced in coping with this trouble.

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The building was opened to the public on 21st October 1909. It remained for ten years in charge of the Superintendent of the Museum, till in 1919, it was transferred to the Department of Fisheries for the two-fold reason that this Department has particular need for the possession of aquarium facilities for the prosecution of its investigations into the life-histories of the local food-fishes, and because of the greater facilities it has for the renewal of the stock of fish and other animals required for the tanks. The change of management has been fully justified for measures were at once taken to increase the number and variety of the exhibits, to remodel the table aquaria, to instal electric lighting and fans and to make the place and its attractions better known. By introducing electric light, it became possible to keep the aquarium hall open after sunset, and at present the evening has become the most popular time to visit the collection; the brilliant illumination of the tanks shows up the colouring of the fishes to greater advantage than when viewed by daylight; troublesome reflections, caused by bright sunshine pouring in through doors and ventilators are eliminated, and the ideal condition for viewing the inhabitants of the tanks is attained—the view from a darkened hall of the tanks lit from behind by brilliant lights hidden from the observer. By the use of electric bulbs, such flexibility is possible in the lighting arrangements that the illumination of each tank can be studied individually and so lit at the best possible angle.

In the year when the Fisheries Department took charge, the total number of visitors who passed the turnstile was 95,957; after the installation of lights and fans, and the introduction of other improvements the number rose to 163,517. To this success the issue of an illustrated handbook has greatly contributed and has proved the best possible means of advertisement. The first edition of 1,500 copies, priced at the nominal charge of one anna, issued in October 1919, was exhausted within four months. A second edition of 5,000 copies, and considerably enlarged, but still priced at the same low figure was issued in February 1920, and was in turn exhausted by the end of 1921, when a third English edition, again revised and enlarged to 39 pages, was published. This actually costs to produce thrice the price charged but for the sake of its educational value and for the advertisement it affords, Government have sanctioned its continued sale at the original and popular price of the single anna. In addition to the English edition, a Tamil translation has been published but curiously enough the English edition continues to be the favourite with Indian visitors. Two rates of admission to the Aquarium are charged, six pies and four annas, in order to permit the poorest to have an opportunity to visit it and also to allow the better classes to have the advantage of seeing it under less crowded conditions than otherwise would be possible. From 2 to 5-30 p.m. admission is half an anna, at all other hours four annas. On Fridays the charge throughout the day is at the higher rate. On the great Indian festivals when thousands flock to see the wonders of the local sea, a special charge of one anna is made all day. Finally in order that no obstacle may stand in the way of any section of the community visiting it, a gosha day, when ladies only are admitted, is arranged for the last Monday in each month; on these days women attendants are in charge of the building.

The Aquarium Hall is a lofty rectangular room, 35′-6″ in length by 50′-6″ wide. To roof this great width, three ridged spans are employed, supported on four rows of slender ornamental pillars; the outside row along each side, is utilized to carry two heavy brass barrier rails,spaced two feet six inches from the front of the tanks. The two short sides are occupied by ten large aquarium tanks built into the walls. Four small rooms, with the entrance vestibule and turnstiles, form the front side, while a large opening in the middle of the rear wall was provided in the original arrangement to permit of visitors seeing into a deep semicircular open-air pool, intended for such large animals as full-grown sharks and turtles which could not be accommodated in the wall-tanks on account

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of their size. Experience has shown this plan to labour under two great disabilities: the great size of the opening, approximately one-third of the entire rear wall space, admitted such an excessive amount of bright sunlight as killed the lighting of the side tanks, while the arrangements did not even permit of the fishes in the tank itself being seen to advantage—partly by reason of the too great depth allowed and partly to reflection of the sky and clouds; in rainy weather the arrangement sometimes led also to the flooding of the floor of the aquarium hall. Accordingly when 'Fisheries' took charge, it was decided to abolish this outside tank, close in the greater part of the opening in the wall and raise the low parapet wall over which visitors used to lean to view the contents of the tank, sufficiently high to accommodate a number of table aquaria. These alterations have proved satisfactory.

In the centre of the hall is an ornamental open freshwater pond sunk in the floor, with a central fountain. Tables carrying small rectangular glass-sided aquaria are disposed about the room wherever they can be conveniently placed, while the two end walls are utilized for the display of typical collections of preserved specimens illustrative of the range of marine animals, dry and in fluid, available in the zoological supply section of the Fisheries Department for educational purposes, such as for dissection in practical zoological studies or for museum display.

The ten large tanks are constructed of masonry. They measure 7 feet in length by 4 feet from back to front, with a depth of 3 feet. The partitions separating them are of Cuddapah slabs (thick slate). Originally the backs of all the tanks were lined with white glazed tiles; this has the great advantage of affording no lodgment for particles of uneaten food and dirt, a consideration of the greatest moment in aquarium management, but it does not satisfy the æsthetic sense and for this reason a rockwork background has been provided in a number of the tanks. Each glass front consists of a plate glass sheet, one inch in thickness, measuring 6′-6″ in length by 3 feet wide. The lower edge and the ends are bedded against a cement-formed ledge in the masonry frame, and after being caulked carefully with putty, an inner ledge of cement is added on the inside of the tank, so forming with the one formed originally on the outside, a deep groove within which the edge of the glass plate is secured. The putty used is a mixture of red lead, white lead and litharge powder amalgamated with boiled linseed oil by means of thorough pounding. In fixing the glass in position, a thick bed of this putty, mingled with oakum to give body, is placed in the half groove on the bottom and the edge of the glass rested on this. The space up each end of the plate is then filled in and only when this is set is the inner ledge of cement placed in position. This latter must not come into contact with the back surface of the glass; a space of $\frac{1}{8}$th inch must be left, to be filled ultimately with the special putty. The upper edge of the glass is held in position by an ornamental wooden cross bar; above this the space between the masonry pillars, between the fronts of neighbouring tanks, is filled in with wooden venetians, with a door in the centre to permit access to the tank in an emergency. The bottom of the tank is three feet from the floor, a height found to be very satisfactory. The higher of the two barrier rails in front of each tank is 3′-6″ from the ground and this, at a distance of 2 feet 6 inches from the glass front of the tank, has also proved to be the correct height.

The method of daylight illumination adopted is from overhead by means of a large square of glass let into the centre of the roof tiling above each tank, the roofing being a continuation of that over one side of the outer span of the aquarium hall. For evening illumination, electric light pendants are employed, 5 or 6 in each tank, with opal glass reflectors. When artificial lighting was first introduced bracket lights were used; these proved unreliable, for the wiring was so subject to wetting and corrosion that short circuiting often occurred

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and for this reason pendants were substituted as the wiring of these is far less liable to damage.

The aëration of these tanks is dual, partly by the inflow of filtered sea-water from a high level reservoir, partly by means of an air compressor delivering air in a mist of tiny bubbles at the bottom of each tank. To obtain sufficiently minute division of the air stream, it is delivered under pressure through filter candles hung in the tanks. By this means, the water is kept so fully aërated that it is possible to maintain a permanent state of overcrowding seldom if ever found, even temporarily, in the open sea. Unfortunately it is not possible to regulate this super-aëration to suit the varying constitutional idiosyncrasies of every kind of fish. Some, in consequence, suffer from a disease that has been appropriately called 'gas-eye.' It arises from an excess of air finding its way into the blood stream, by absorption through the gill-membranes; the outward sign of the disease is the partial protrusion of the eye-balls. Many of the fish affected eventually recover, and all do so quickly if transferred to ordinary sea-water. A proportion die either directly from what appears to be a form of asphyxiation, or indirectly from the onslaught of the other fish in the tank, to whom the sight of a protruding eye-ball is the signal for attack; the eye-ball in these cases is often plucked out and if the fish be small, it is often killed outright. The larger ones after losing an eye not infrequently recover and this accounts for the presence of quite a considerable number of the larger fishes in the tanks being short of one eye. The air circulation is effected by means of a manual air compressor which stores up compressed air in two cast iron cylinders, whence an outflow is led through tubing to the various tanks. The table aquaria successfully depend wholly on compressed air aëration, even in the hottest weather.

The water circulation arrangements comprise three underground reservoirs which may be named A, B and C at the rear of the aquarium, a gravel filter bed, and a high level supply tank. A pipe from the sea margin conveys new supplies of sea water when required to the median reservoir A, whence it is pumped by hand into the filter; from there it passes into the underground storage reservoir B used normally for filtered water only. From this supplies are again pumped by a cooly into a high level iron tank, whence the water flows by gravitation, controlled by stop cocks, to the several aquarium tanks. The overflow from these is at the surface, and flows back to storage reservoir C, to be pumped by hand into the filter bed, in order to be freed from impurities before entering again into circulation. Each tank is also provided with a clean-out pipe-exit at the bottom, for use when the tank has to be emptied for any purpose. The piping used is of galvanized iron, the stop cocks being of brass or gun metal. In spite of considerable corrosion, the original piping is still serviceable.

The table tanks are of various types as the first patterns have been greatly improved upon of recent years. The most useful form is one where the base is composed of a single plank of teak (2½ inches thick), carrying four stout upright grooved pillars at the corners, into which the four glass plates forming the sides and ends are let. The grooving is puttied with the same material as in the larger tanks, and as an additional waterproofing precaution, a thick layer of asphaltum is poured hot over the wooden bottom on the inside. An ornamental wooden beading finishes off the upper edge of the tank and supports a protective cover-frame.

The floor tank has not been a success as it has been found impossible to light it satisfactorily. Murrel and Gourami live well in it and the former have bred there several times, the parents watchfully guarding the nest; they resent actively any prying into their domestic affairs on the part of visitors. The four rooms at the front of the building comprise two store rooms, a pump room, where the air compressor is located, and a curator's room. At the rear of the building, an additional laborato has recently been built, as the need for such a convenience

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has long been urgently felt. The main hall and the principal side rooms are furnished with electric ceiling fans, an improvement of recent date and one greatly appreciated by visitors particularly on crowded days in the hot weather.

All the fishes exhibited have been obtained in the neighbouring sea, within ten miles from Madras itself. Varied as is the collection, it comprises probably not one-tenth of the species available in these waters. Many among the common edible fishes, such as hilsa, mackerel and various sardines are too delicate to stand handling and transport to the tanks. The local fishermen too are reluctant to bring the better class of edible fishes, as they still entertain a belief that one object of the Aquarium is to breed fishes and they fancy that if this be done, there may be such a glut of fish that they will obtain but poor prices for their catches! Other classes of fishes are unattractive or too bulky to exhibit.

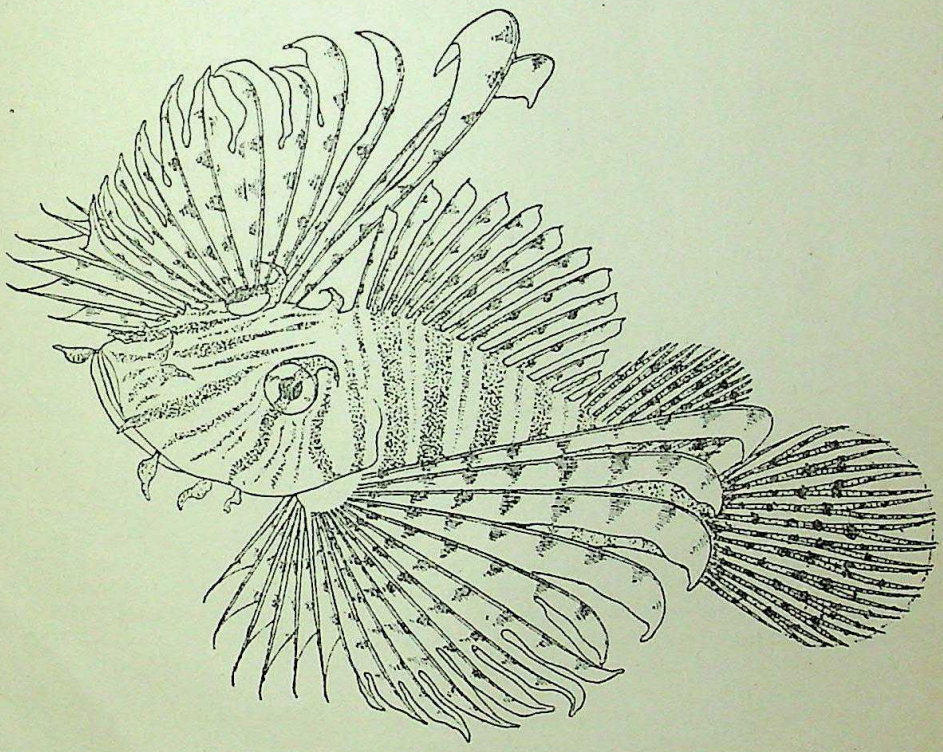

FIG. 1.—The Scorpion Fish (*Pterois russelli*).

Among the most showy fishes are the Scorpion-fish (*Pterois russelli*), the Butterfly-fishes (various species of *Chætodon* and *Holocanthus*) and the Parrot-fishes (*Julis* spp.). The first named are magnificently ornate creatures that compel attention and admiration; the pectoral fins have attained dimensions far beyond anything requisite for swimming and must have some other reason—probably that of warning, for this fish is endowed with virulently poisonous spines in the dorsal fin. This fish's movements are those of a mannequin on show when it swims; it sails along very slowly and gracefully, with a just perceptible fluttering of the great butterfly-like fins; it often halts for moments together

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as though asking for admiration and at times will even slowly rotate that one may view it from all points.

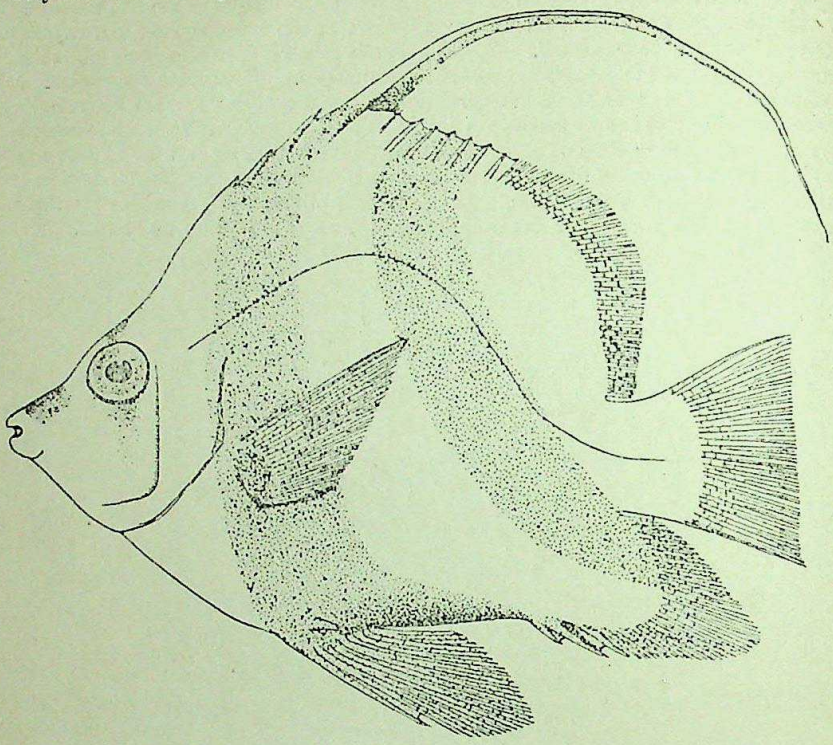

FIG. 2.—Yellow-finned Butterfly-fish (*Heniochus macrolepidotus*).

Another extremely pretty fish is the yellow-finned Butterfly-fish, *Heniochus macrolepidotus*. Its bold black and white vertical banding and yellow fins claim notice and admiration. The dorsal fin carries a long yellow streamer often missing however, as it is too tempting to other fishes, which generally bite it off. Like many other pretty creatures, it is of a vicious nature and is inclined to play the bully towards the wounded or the sick.

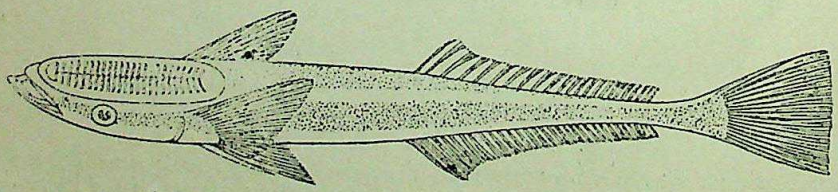

FIG. 3.—The Common Sucker-fish (*Echeneis naucrates*).

Small specimens of the Tiger-shark remarkable for the beauty and intensity of its black and white striping, are usually present in the tanks, living together with such other notable sea-creatures as the Murænid eels and the curious sucker-fishes (*Echeneis naucrates*), often called 'Remora.' These latter are so named from the presence of a long sucker organ on the upper part of the head, made up of a double row of transverse plates set in an oval frame. By

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its help these fishes are able to attach to ships, whales and turtles, and so get carried about without effort on their part. In some parts of the world this habit has been utilized by fishermen in the pursuit of turtle, a sucker-fish with one end of a strong cord tied to the tail being set free when a turtle is seen resting on the surface of the sea. The Remora instantly swims to the turtle, as being a suitable object to affix to ; when attached, the fishermen haul in the line and with it both turtle and sucker-fish. Columbus described this custom as practised by the Caribs. Though not now practised in the West Indies, it appears to be in use on the African coast and by the ever ingenious Chinese.

A tank containing a large number of the Rosy-banded Snapper (*Lutianus sebæ*) is very popular, so beautiful are these fishes, banded dark crimson and white. Like so many other fishes these snappers change colour on occasion. When spoiling for a fight or struggling for food their colour bands gain greatly in intensity, fading considerably when resting.

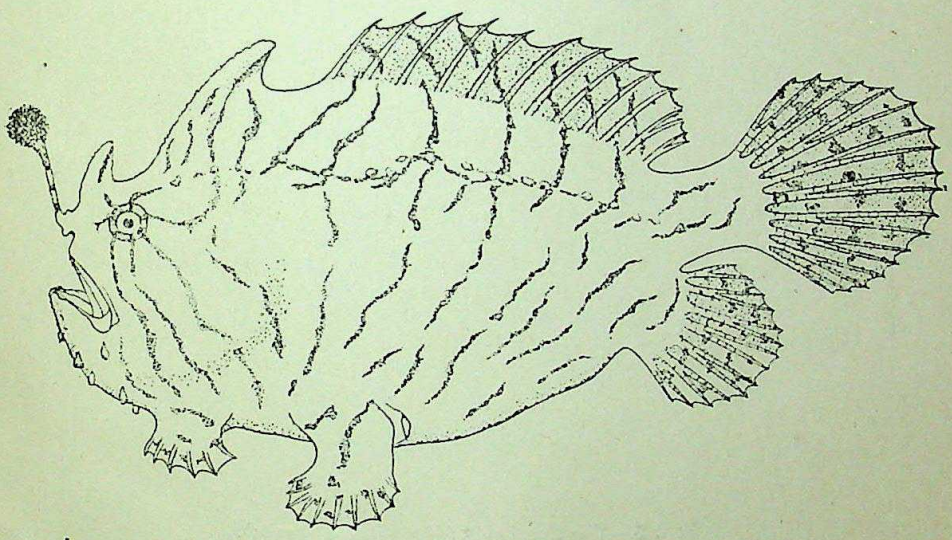

FIG. 1.—The Yellow Angler (*Antennarius hispidus*).

Other noteworthy fishes are the Yellow Anglers, *Antennarius hispidus* and *A. nummifer*. The former is quite common at Madras, and some are always present in the tanks. Like its well-known European relative, *Lophius*, (the Fishing-frog), the first dorsal fin ray is modified into a miniature fishing-rod with a fluffy white tassel at the end to represent the bait. It is a lumpy little fish, yellow in colour with numerous dark stripes, possibly colour markings that subserve a protective function. Its custom is to lie inert and motionless, flicking their tassel-bait nervously to and fro to the end that some inquisitive little fish may be attracted to enquire into what curious thing this may be. If he come close enough, a great gape of mouth opens suddenly and the little fish disappears. The feeding of these fishes always causes absorbed interest on the part of visitors. They are so accustomed to have their prey come to them and literally fall into their mouth that when feeding time comes, their more active tank companions give them no chance to get food. So the attendant has to transfix a morsel of fish on the end of a wire and dangle it above the face of the fish, which generally snaps it up just as the attendant's patience is on the verge of exhaustion.

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The File-fishes (*Balistidæ*), the Spinetails (*Acanthurus* spp.) and the Puffers (*Tetrodontidæ*), form other attractive exhibits either because of the beauty of their colouring or the curious form assumed. Small electric rays, (*Narcine indica* and *N. brunnea*), are generally present to give sharp little shocks to visitors bold enough to handle them.

Both the two local Cichlid fishes, *Etroplus suratensis* and *E. maculatus*, remarkable for their adaptability to life either in salt or in fresh-water, are represented in the collection. The former, which may appropriately be termed the Pearl-spot, grows to a marketable size and has an excellent flavour ; it is assuming considerable economic importance in Madras for these reasons in the scheme now being put into force for the restocking of inland tanks with a better class of fish. Both species have peculiar nest-building habits, their eggs being adhesive and deposited on the under side of stones and logs in shallow waters. The Pearl-spot breeds equally well in fresh and brackish water and is altogether a remarkable and valuable species.

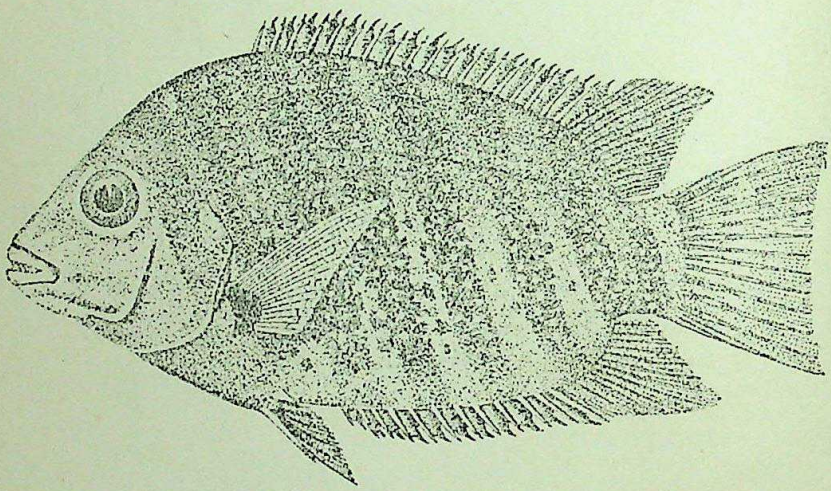

FIG. 5.—The Pearl-spot (*Etroplus suratensis*).

Quite a number of the fishes have lived for many years in the aquarium tanks, notably several sea-perches of the genus *Serranus*. Three of these have lived in the aquarium between 10 and 11 years, having been brought in quite small, soon after the building was opened. Their growth has been considerable and now they must weigh from 20 to 25 lbs. each. They furnish living evidence of the healthy conditions prevailing in the tanks for their condition is perfect and any injuries received when fighting—they snap viciously at each other on occasion—heal rapidly and completely.

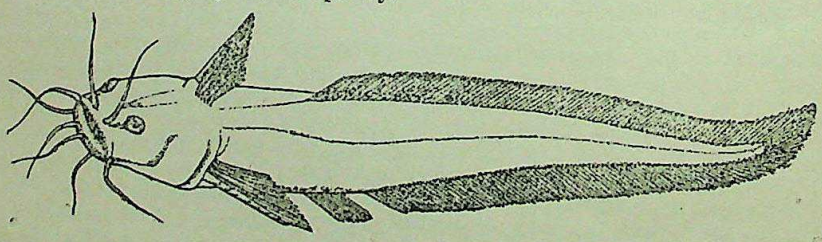

FIG. 6.—A common Cat-fish (*Plotosus canius*).

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Another old resident is a very large Cat-fish, *Plotosus canius*, that has a great attraction for visitors because of his superlative ugliness. An allied genus, *Arius*, is also often shown in the tanks and is perhaps even uglier than *Plotosus*; a point of interest in certain species of *Arius* is that the male has the curious habit of receiving the eggs, as extruded by the female, into his mouth where he retains them till the young hatch out. As the eggs are particularly large, about half an inch in diameter, the number that he can care for is limited. The eggs completely fill his mouth, so the poor father has to abstain from feeding till his family is born, and able to swim away.

Of fresh-water fishes, the nest-building murrel and gourami find a home in the central floor pool, while a table tank accommodates examples of the curious climbing perch *Anabas scandens*, called in Tamil by a descriptive name that translates into "the Perch that climbs Palmyra palms"; in another are shown scores of the little fishes *Haplochilus melanostigma* and *Panchax parvus*, that are now being bred in thousands by the Fisheries Department for the purpose of destroying mosquito larvæ in ponds and pools. These are supplied at low rates to public bodies interested in combating the malaria scourge; when properly cared for, these fishes thrive and multiply prodigiously and subserve this mosquito-larvæ destroying purpose admirably.

One tank is given up to various species of sea-snakes abundant in the sea off Madras. This exhibit has very great attraction for visitors, who look with awe on these super-poisonous creatures, possessing venom several times more deadly than that of the cobra. Actually they are most inoffensive creatures, except towards fish on which they prey, or in the rare case of being trodden on by some incautious foot. The attendants do not fear them nearly so much as they fear the pretty harmless-looking *Pterois russelli*. And there are always a few small sea-perches in the same tank that unconcernedly snatch fragments of meat from amid the writhing coils of these snakes at feeding time.

Little accommodation is available for other exhibits than fishes, but usually some of the more curious crustaceans and molluscs of the district are represented. Among the former are the spiny Crawfish (*Panulirus*), various swimming crabs such as the blue-limbed *Neptunus pelagicus*, the three spotted *N. sanguinolentus*, and the strange little *Dorippe dorsipes*, camouflaging itself by holding a bivalve shell over its back with the aid of the two last pairs of legs that have been modified specifically for this purpose. Of Molluscs, examples of the Sacred Conch, *Turbinella pirum*, and various spiny Murices are often present, together with small examples of the Octopus of a species caught in thousands by the fishermen of Palk Bay in curious shell traps, tied in large numbers on long lines laid in shallow water.

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NEW AND LITTLE KNOWN INDIAN BOMBYLIIDÆ

BY

LIEUT.-COLONEL C. G. NURSE.

(*With a plate.*)

The publication of Brunetti's Vol. I, Diptera Brachycera of the Fauna of British India series has stimulated me to attempt the determination of some of the Diptera I had collected while in India. My entomological energies during the last part of my Indian service were devoted chiefly to Hymenoptera, but I carefully preserved any conspicuous Diptera that I came across, and thus amassed a fair amount of material. Having recently come to reside in London in close proximity to the Natural History Museum, I have had opportunities of comparing my specimens with those in the national collection, and of access to the unrivalled library of the Museum. In working through the *Bombyliidæ* I found that I had taken representatives of several genera which had not previously been recorded from India, and a considerable number of species which are either undescribed, or have only been recorded from outside Indian limits. I therefore decided to publish the result of my studies.

I have to acknowledge the kind help of Major E. E. Austen, D.S.O., who has not only given me the benefit of his opinion from time to time, but has also placed at my disposal his private copies of several pamphlets dealing with the *Bombyliidæ*.

The present paper covers only the genera *Litorrhynchus* and *Exoprosopa*, but I hope later on to work through the other genera of *Bombyliidæ* as represented in India.

Litorrhynchus, Macq.

This genus, of which the original spelling was *Litorynchus*, was erected in 1840 by Macquart to include certain species of *Exoprosopa* which have a more or less rounded face, long proboscis, and peculiar wing pattern. Most subsequent authors, including Brunetti in Vol. I, Diptera Brachycera, have sunk it as a synonym of *Exoprosopa*. I follow Professor Bezzi (Tr. Ent. Soc., 1911, p. 629) in keeping the two genera distinct, although one or two of what he regards as the essential characters of the genus do not quite apply to the only two species known from India. In these the proboscis, though considerably longer than the head, is not twice as long, and the style is somewhat shorter than the 3rd antennal joint.

The two Indian species may be distinguished as follows :—

Sides of 1st abdominal segment with white hairs .. .. *lar*, Fab.

Sides of 1st abdominal segment with black hairs .. .. *collaris*, Wied.

Brunetti sinks *collaris* as a synonym of *lar*, but I hold very strongly that they are quite distinct. The wing band in *collaris* is darker than in *lar*, and its outer border less rugged. The ground colour of the abdomen in *collaris* is black and in *lar* rufous or rufescent. In *lar* there are white hairs near the apex of abdomen, but these are absent in *collaris*. These differences are not sexual, as I have both sexes of *collaris*.

Both species appear to be widely spread in India ; Brunetti records them from various localities, and I found both at Deesa and Jubbulpore. The pubescence on the abdomen of most of my specimens of *collaris* is not at all rubbed, and the hair at the sides of the 1st abdominal segment is pure black, though there are a few white hairs on the thorax below the postalar calli.

The figure of the wing (fig. 3, plate III) given in Vol. I, Diptera Brachycera, agrees better with *collaris* than with *lar*.

The two specimens now in the British Museum mentioned by Brunetti on p. 196 as having been obtained by Col. Yerbury in Ceylon, belong to two different species, and should probably be assigned to *Exoprosopa* rather than to the

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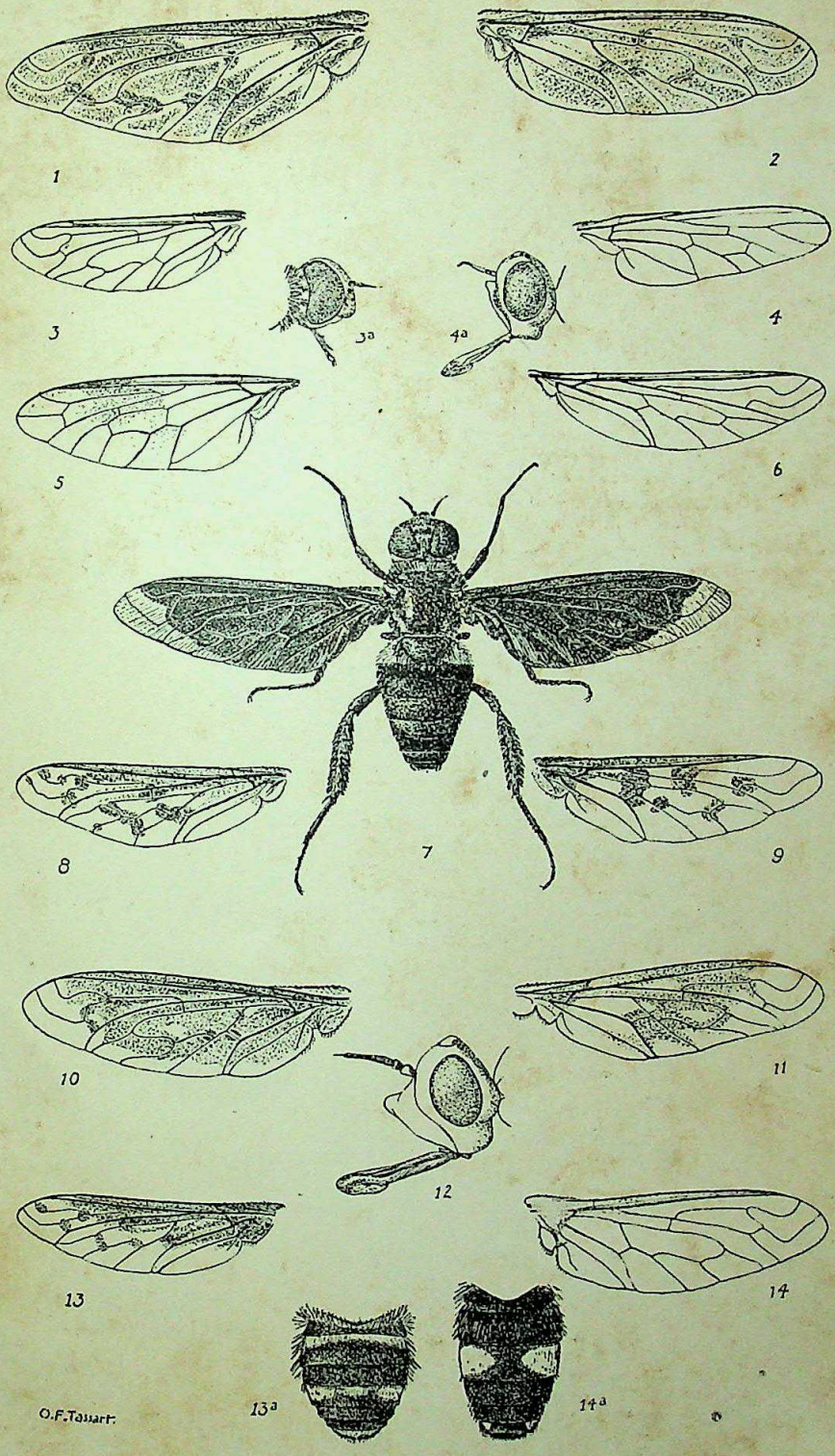

SOME INDIAN BOMBYLIIDÆ.

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present genus. The one labelled "? *binotata* Macq." does not agree with Macquart's description of that species.

Exoprosopa, Macq.

This is a very rich and rather heterogeneous genus, as Professor Bezzi remarks in Tr. Ent. Soc., 1911, p. 635. It will probably be split up eventually, and some of the species at present included in it will have to go elsewhere. In working out my specimens I was much puzzled by a species that occurs at Mount Abu, which has the neuration of *Exoprosopa*, but the wing pattern of *Thyridanthrax*. Looking over some insects which had recently been returned to the British Museum by Professor Bezzi, I found that he had described it as a *Thyridanthrax* from Africa, where it is widely spread. I also note that he now places Loew's *Exoprosopa lata* in *Thyridanthrax*, although he recorded it as an *Exoprosopa* in Tr. Ent. Soc., 1911, p. 645.

When the Indian dipterous fauna becomes better known, the number of species of *Exoprosopa* that occur in that country will certainly be increased by numerous additions. There are, both in the British Museum and in my own collection, a number of specimens which undoubtedly belong to undescribed species, but in most cases they are in indifferent condition, and to describe new species from examples more or less denuded of their pubescence is only to increase the difficulties of future students of Diptera. As regards the generic characters Brunetti makes a slight slip on p. 190 of Vol. I. His statement "all tibiæ without spinules" should read "fore tibiæ without spinules," as most of the species, if not all, have spinules on the intermediate and posterior tibiæ.

The following key to the species recorded from India is based as far as possible on Brunetti's table of species on pp. 190-192 of his work. It must not be taken as dividing them according to their affinities, but it ought to assist a collector to name his specimens, unless he obtains anything new to India. In preparing the key I have relied on Brunetti's descriptions as regards the following species —*flavipennis*, *otylata*, *puerula*, *annandalei*, *brahma*, and *vitrea*. All the other species are represented either in the British Museum or in my own collection.

Key to the Indian Species of EXOPROSOPA.

1.	1st posterior cell closed	2
	Do. open	9
2.	Wings bright yellow at base	3
	Wings not bright yellow at base	5
3.	Wings with two brown bands	*flammea*, Brun.
	Wings with only one brown band	4
4.	Abdomen with the ground colour black	*flavipennis*, Brun.
	Do. do. red	*tamerlan*, Portschinsky.
5.	1st posterior cell long stalked	6
	Do. short stalked or closed on the margin	7
6.	4th longitudinal vein interstitial with cross vein connecting 3rd and 2nd longitudinal veins ..	*interstitialis*, n. sp.
	4th longitudinal vein not interstitial	*fusconotata*, Beck.
7.	Wings very dark brown at base	*siva*, n. sp.
	Wings not dark brown at base	8
8.	Apex of wings hyaline	*albida*, Walk.
	Do. more or less infuscated	**abjecta*, n. sp.
9.	Wings wholly black or blackish	*latipennis*, Brun.
	Wings not wholly black or blackish	10

* This species sometimes has the 1st *posterior* cell open, and therefore appears again below.

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10. Hind tibiæ with long and dense scales 11
Do. without long and dense scales 12
11. Sides of 1st abdominal segment with black hairs .. *pennipes*, Wied.
Do. do. white hairs .. *pennata*, n. sp.
12. 1st posterior cell with an additional transverse vein in its centre .. .. .. *evanescens*, Beck.
Do. without an additional transverse vein in its centre 13
13. 2nd posterior cell twice as wide at base as at tip .. 14
Do. as wide at tip as at base or wider 15
14. Larger ; 14-18 mm. ; sides of abdomen with black hairs .. .. *lateralis*, Brun.
Smaller ; 8-12 mm. ; sides of abdomen without black hairs .. .. *gujaratica*, n. sp.
15. Baso-anterior half of wing considerably darker than the remainder 16
Basi-anterior half of wing not or scarcely darker than the remainder 21
16. Dorsum of abdomen with white scale-spots .. 17
Do. without white scale-spots .. 18
17. Larger ; 14 mm. ; antennal style normal .. .. *maculiventris*, Brun.
Smaller ; 8 mm. ; antennal style as long as 3rd joint *stylata*, Brun.
18. Clear part of wing without isolated dark spots .. *puerala*, Brun.
Do. with isolated dark spots 19
19. Abdominal ground colour, black or blackish .. *insulata*, Walk.
Abdominal ground colour, red or brown 20
20. Baso-costal band flavous .. .. *abrogata*, n. sp.
Do. not flavous .. .. .. { *alexon*, Walk. / *annandalei*, Brun.
21. Wings more or less infuscated, though there is no distinct baso-costal band 22
Wings almost clear, though the marginal cell may be darkened 24
22. Tip of wings hyaline .. .. *dissoluta*, n. sp.
Do. not hyaline 23
23. Wings mainly tawny .. .. *auriplura*, Walk.
Wings not at all tawny .. .. *abjecta*, n. sp.
24. Thorax and abdomen with iridescent blue scales .. *iridipennis*, n. sp.
Do. white or grey scales .. 25
25. Cross veins more or less suffused 26
Do. quite clear 27
26. Scutellum and antennæ, black .. .. .. *bengalensis*, Macq.
Do. reddish yellow or brown .. *brahma*, Schin.
27. Antennæ wholly black 28
Some joints of antennæ red or ferruginous 30
28. Larger ; 15 mm. or more .. .. *niveiventris*, Brun.
Smaller ; 13 mm. or less 29
29. Thorax and abdomen with bright yellow hairs .. *vitrea*, Brun.
Do. without bright yellow hairs .. *punjabensis*, n. sp.
30. Antennæ entirely brownish yellow .. .. .. *vitreipennis*, Brun.
Do. only ferruginous at base .. .. .. *basifascia*, Walk.

(In order to assist entomologists working in India, I have given below abbreviated descriptions of any species now recorded from Indian limits which have already been described, but which are not included is Vol. I of Diptera Brachycera.

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Exoprosopa tamerlan, Portschinsky.

Horæ Soc. Entom. Ross, Vol. XXI, p. 185.

♂♀ Head, including antennæ, thorax. and abdomen mainly or entirely red, covered with rufous scales and rather sparse pubescence of similar colour; 3rd abdominal segment bears a small spot of white scales on each side, but this is often obsolete or abraded: legs mainly black, wings with a broad yellow bases costal band, margined posteriorly by a brown band, the latter varying considerably in width and intensity, apical and posterior margin hyaline; 1st posterior cell closed, the 4th vein meeting the 3rd nearly half way between the fork of the latter and the wing border.

Length 18-21 mm.

This fine species is common at Quetta, where I obtained nine specimens which agree well with Portschinsky's description, and also with the figure given in Becker's Persische Dipteren.

Originally described from Merv, and Becker records it from Persian Baluchistan.

Exoprosopa interstitialis, n. sp.

♂. Head; frons at level of antennæ rather more than one-third the width of head, not much narrowed at vertex; upper mouth edge protruding, viewed in profile fully half the short diameter of the eye; vertex black, with short stiff black hairs which extend nearly to the antennæ, frons and face yellowish, covered with yellowish grey scales, below which a black spot is visible just above the upper mouth edge; lower mouth edge very pale testaceous; antennæ brownish black, 1st and 2nd joints with stiff black hairs, 3rd joint, excluding style, as long as the first two combined, gradually tapering, with style $\frac{2}{3}$ of its length; proboscis rather long, blackish, palpi dark brown; occiput blackish, with a fringe of white scales along eye margins.

Thorax black, with a collar of pale yellowish grey scaly hairs, extending back towards the wing bases; disc covered with yellowish grey scales, bristles at base of wings and on postalar calli pale yellow; mesopleuræ with grey pubescence, scutellun reddish brown, with scales similar to those on the thorax; marginal bristles pale.

Abdomen mainly brick red, but all the segments are more or less black at base; disc with grey scales (partially denuded), and with a few short stiff hairs on apical margins of segments, especially towards the sides, which are thickly covered with greyish scaly hairs; venter red, covered with grey scaly hairs.

Legs chiefly red; coxæ with long grey pubescence, femora and tibiæ covered with grey scales, tarsi brownish, becoming nearly black towards apex; intermediate and posterior tibiæ with black spinules.

Wings dark brown, with a flavous tinge at base to beyond humeral cross vein; there is a very ill-defined oblique median darker band, and there are dark suffusions on all the cross veins, but the following portions of the wing are sub-hyaline, *viz.*, the greater portion of 2nd basal cell, base of anal cell, apical half of discal cell, and most of the marginal and posterior cells; in the apical fourth of wing the discs of the cells are darker than in the immediate vicinity of the longitudinal veins; the first posterior cell is closed and long stalked, the 4th longitudinal vein joining the 3rd at a right angle, and being interstitial with the cross vein connecting 3rd longitudinal vein with the lower branch of the 2nd; most of the larger longitudinal nervures are reddish brown, the smaller ones appearing darker; base of costa with numerous but very short bristles, and some golden yellow scales; halteres pale yellow, fringe of alulæ smoky.

Length 15 mm.

Described from a single specimen taken at Quetta in May. I cannot find among published descriptions any species which combines wing markings as described above with a closed 1st posterior cell.

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Exoprosopa fusconotata, Becker.

Persische Dipteren., Ann. Mus. Zool. St. Petersburg, 1912, p. 566.

Head yellow or yellowish, antennæ black ; thorax and scutellum blackish brown, with yellow and white scales and yellow bristles. Abdomen blackish brown, with white interrupted bands on the first four segments. Legs black ; wings greyish, marginal cell yellowish brown ; a brown suffusion at the posterior corner of discal cell ; 1st posterior cell closed at a right angle, and stalked.

Length 10½ mm.

The four specimens taken at Quetta agree well with Becker's description.

Exoprosopa siva, n. sp.

♂ ♀ Head ; frons at level of antennæ one-third the width of head, at vertex about one-sixth in both sexes; black, covered with pale golden yellow scales and black hairs, which are longest on the frons; occiput with short whitish pubescence : antennæ black, 3rd joint rather short, being not much longer than the style : 1st and 2nd joints with black hairs, 3rd bare ; proboscis nearly twice as long as head.

Thorax black ; pronotum and sides with rather long pale yellowish hairs, dorsum with pale golden scales, bristles at base of wings and on postalar calli black ; underside of thorax black with black hairs ; scutellum black, with pale golden scales and black bristles, some of the latter being very long.

Abdomen black ; 1st segment with pale yellow hairs, 2nd with a narrow basal band of similarly coloured scales, 4th and 7th segments with broad basal bands of pure white scales ; venter black, sparsely clothed with greyish hairs and some yellow scales.

Legs entirely black, with some pale scales on femora and tibiæ.

Wings brownish grey, with an oblique blackish baso-costal band reaching the tip of the 1st longitudinal vein, leaving the outer and posterior margins, including most of the anal and axillary cells, clear ; on the clearer portion are the following blackish spots or suffusions, *viz.*, a spot near apex of upper branch of 3rd longitudinal vein, one at the fork of this vein, and one on the cross vein which joins the 3rd and 4th longitudinal veins, one at the apex of discal cell, extending into 2nd posterior cell, one smaller spot at lower margin of discal cell where it is joined by 5th longitudinal vein. The 1st posterior cell is closed a short distance before the margin.

Length 7-10 mm.

Described from four good specimens from Matheran. There is a similar specimen in the British Museum from Mahapur.

This species is quite distinct from *insulata* Walk, to which it bears a superficial resemblance (see remarks on that species below). It differs as follows ; the wings are somewhat shorter, and the 1st posterior cell is closed, whereas it is open in *insulata*. The latter species has apical bands of yellowish scales on the 3rd and following segments, that on 4th being the most conspicuous, whereas *siva* has broad basal bands of snow-white scales on 4th and 7th segments. The oblique basocostal band is narrower in *siva*, and the spots are smaller and differently placed.

Exoprosopa albida, Walker.

Five specimens from Deesa agree with the type and description of this species. The shape of the 1st posterior cell is evidently variable ; in the type it is closed and stalked ; one of my specimens agrees with the type, but in the others it is closed just on or near the margin. It varies considerably in size, my largest specimen measuring 16 mm., and the smallest 11 mm. This species is very doubtfully distinct from *E. bagdadensis* Wied, which Becker records from Persian Baluchistan. The latter has the first two antennal joints testaceous, whereas in *albida* the basal joint only is of this colour.

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Exoprosopa abjecta, n. sp.

♂ ♀. Head ; frons at level of antennæ about $\frac{2}{3}$ the width of head, at vertex rather more than half as wide as at antennæ; blackish at vertex, reddish towards antennæ, becoming paler near mouth edge ; facial bump viewed in profile about $\frac{2}{3}$ the short diameter of the eye ; frons and face thickly covered with greyish white scaly hairs, which are longer near antennæ ; antennæ dark red, 3rd joint more or less darkened, gradually tapering, rather longer than the 1st and 2nd joints taken together ; style about half the length of 3rd joint ; 1st joint with thick greyish hairs, 2nd with short black bristly ones.

Thorax blackish, covered with grey scales ; pronotum with a collar of very pale yellowish hairs ; thorax below and at the sides with rather long grey hairs ; scutellum dark red, with grey scales; base of wings, postalar calli, and scutellum with long yellow bristles.

Abdomen both above and below covered with short greyish scales ; 2nd segment above with a transverse apical band of dark brown scales, and 3rd segment with indications of a similar band ; the ground colour of the abdomen is black, but the sides and apical margins of all the segments are red.

Legs red, tarsi blackish ; femora and tibiæ more or less covered with grey scales, and with short black spinules on intermediate and hind legs.

Wings light brown, darker at extreme base ; an ill-defined oblique darker band runs from the middle of the anterior margin to the anal cell ; the apical portion of the 4th longitudinal vein is strongly curved, the 1st posterior cell being either just open or closed on the margin (in one specimen closed and short stalked) ; all the cross veins have darker suffusions ; in the apical portion of wing the longitudinal veins are lighter margined, leaving the middle of the cells darker ; the 2nd posterior cell is slightly wider at apex than at base ; base of costa with yellowish grey scales, mixed with short black bristles ; halteres yellowish white.

Length 9-12 mm.

Described from eight specimens obtained at Deesa in March and April.

The oblique median wing band varies considerably in intensity ; in some specimens it is very noticeable, while in others it is scarcely darker than the rest of the wing. The ground colour of the abdomen varies from mainly red to mainly black. There appears to be little or no difference in the width of frons in the sexes.

Exoprosopa pennata, n. sp.

♂. Head with frons at antennæ about $\frac{1}{3}$ the width of head, at vertex about $\frac{1}{3}$ as wide as at antennæ ; frons black; with short stiff black hairs and traces of white scales; face black, covered with similar black hairs and a few white scales near eye-margins ; antennæ with 1st joint dark red, with stiff black hairs, 2nd joint black, 3rd dark red, blackish at base, gradually tapering, with similarly coloured style, which is about $\frac{1}{3}$ the length of joint; proboscis and palpi black at base, becoming reddish at apex ; occiput with whitish scales near eye-margins.

Thorax black ; pronotum with a collar of greyish black hairs, dorsum covered with iridescent blue scales; a patch of snow-white scales near base of wings, the remainder of sides with stiff black hairs, mixed with a few grey ones; a few short black bristles near wing-base, and similar longer ones on postalar calli ; scutellum black, with traces of blue scales, and black marginal bristles. Abdomen black, covered with iridescent blue scales ; 1st segment with a conspicuous patch of snow-white scaly hairs on each side ; sides of the remaining segments with shorter and stiffer black hairs ; venter with the basal white patches on 1st segment extended below, and traces of white scales on segments 2-5.

Legs black, fore tibiæ and tarsi rufescent, intermediate tibiæ with several rows of moderately long spinules; a patch of white scaly hairs on posterior coxæ; the posterior femora at tip and the whole of the posterior tibiæ covered with long and dense brownish black scales.

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Wings blackish brown, hyaline at tip and along posterior margin, the pale portion of wings limited by the tip of 2nd longitudinal vein and not quite reaching the apex of anal cell ; 1st posterior and anal cells open ; alula with a fringe of whitish scales ; halteres brownish.

♀ Similar ; frons a little wider.

Length 16-18 mm.

Described from 4 specimens in good condition from Quetta.

Nearest to *E. pennipes* Wied, from which it differs in the antennæ being mainly dark red, the patches of snow-white scales at sides of 1st abdominal segment, and the more extended clear portion of the wing margin. The dark portion of the wing has in the present species a more brownish tinge than in *pennipes* ; in one of my specimens there are somewhat lighter portions in the 2nd basal, discal, and anal cells.

The specimen from Karachi mentioned by Brunetti on p. 198 of Vol. I, Diptera Brachycera, evidently belongs to this species.

Exoprosopa evanescens, Becker.

Persische Dipteren, Ann. Mus. Zool. St. Petersburg, 1912, p. 559.

I have eight specimens from Quetta which exactly correspond with Becker's description.

Head, including 1st two antennal joints, scutellum, apical portions of all abdominal segments, coxæ, femora, and tibiæ, red ; 3rd antennal joint, dorsum of thorax, bases of abdominal segments, and tarsi, black or blackish. Head and thorax covered with pale yellow scales, abdomen with grey scales. Wings lightly infuscated, apical and posterior margins nearly clear, all cross veins darkened ; the 1st posterior cell is crossed near its centre by a transverse vein (" mit einer überzähligen Querader "). The latter character is uncommon in the genus *Exoprosopa*, though it occurs in *E. singularis* Macq., and a few other species.

In Becker's type the 3rd antennal joint was broken off ; all my specimens have this joint black, rather long and slender, with the style, which is about $\frac{1}{3}$ the length of joint, testaceous.

Exoprosopa gujaratica, n. sp.

♂ Head dull red, with short greyish pubescence, intermixed on frons with short, stiff, black hairs ; frons at vertex about $\frac{1}{5}$ the width of head, at antennæ about $\frac{1}{3}$; proboscis black ; 1st antennal joint yellow, hairy ; second black at base, with apex yellow ; 3rd black on blackish, style thick, about $\frac{1}{2}$ the length of 3rd joint.

Thorax black above, rufescent below, with short but thick greyish-yellow pubescence ; pronotum and sides with longer light yellow hairs ; bristles near base of wings and on postalar calli black ; scutellum reddish brown towards apex covered with pubescence similar to that on thorax, with black marginal bristles.

Abdomen broadly blackish above, but red at sides and on apices of segments, pubescence concolorous with that on thorax, no black hairs at sides or at apex.

Legs red; coxæ, tips of fore femora and tibiæ darkened, all tarsi black ; femora and tibiæ sparsely covered with greyish scales ; intermediate tibiæ and posterior femora and tibiæ with the usual spinules.

Wings rather dark brown, with a narrow border, lighter but not hyaline, extending from the point where 1st longitudinal vein joins the costa rather irregularly to the anal margin ; halteres yellow.

♀ Similar ; vertex slightly broader.

Length 8-12 mm.

Described from six ♂♂ and 2 ♀♀ from Deesa, all taken in October.

This species is nearest to *E. lateralis* Brun, from which it differs in its smaller size, the absence of any black hairs on abdomen, and the extent of the lighter margin of the wings. In the present species the lighter portion is much narrower than in *lateralis*, and less well defined ; there is no lighter indentation running into

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discal cell. A series of both species seen side by side appear quite distinct. I have *lateralis* from Mount Abu and Matheran, but did not obtain it at Deesa.

Exoprosopa insulata, Walk.

There are several Indian species with wing markings somewhat similar to *insulata*, Walk., and I found four distinct species standing over that name in the British Museum *viz.*,

(*a*) *insulata ;* two specimens, including the type, from "East Indies"—also a specimen from Assam.

(*b*) a specimen from Dehra Dun, not good enough to describe. It has a pure white band at the base of 4th abdominal segment, and the 1st posterior cell just open.

(*c*) Two specimens from Ceylon (Col. Yerbury), not in good condition. These have the 1st posterior cell closed.

(*d*) A specimen from Madhapur, with the 1st posterior cell closed. This agrees with my specimens from Matheran, which I have described above as *Exoprosopa siva.*

Brunetti probably had two or more species before him when he wrote the description of *insulata* on pp. 203-5 of Vol. I, Diptera Brachycera, though the figure of the wing on Plate III corresponds well with Walker's type, and with my specimens. I therefore give below the points in which his description differs from the type.

The proboscis does not project beyond the tip of antennæ, but just beyond the upper mouth edge, (in my *E. siva* the proboscis projects well beyond the tip of antennæ). I should describe the abdomen as follows :—

Ground colour black, covered mainly with black scales ; 1st segment with a band of rather long yellowish brown erect hairs, 2nd segment with a complete basal band of pale yellow scales, 3rd and following segments with apical bands of similar but rather lighter scales, those on the 3rd and 4th segments the most conspicuous and extending over the side margins, on the other segments these bands are narrower and sometimes hardly noticeable ; the whole of the dorsal surface of abdomen thinly covered with fine long black sinuous hairs ; venter blackish, with black hairs, except on the 1st segment where the yellowish hairs extend well over the sides.

The wings have the dark colouring extending over the basal half of the discal cell, and the basal $\frac{2}{3}$ of the anal and axillary cells, and the spots are situated as follows :—One at the bifurcation of 2nd vein, being merely an extension of the baso-costal band ; one right across the vein closing the apex of discal cell, connected anteriorly with the dark portion of the wing ; free dark spots as follows : two larger ones, one near apex of upper branch of 2nd longitudinal vein, and one over cross vein connecting lower branch of same vein with 3rd longitudinal ; two smaller spots towards apex of lower branch of 2nd longitudinal vein, and one each near apex of 3rd, 4th, 5th and 6th veins, some of the latter being very faint ; both the 1st posterior and anal cells are widely open ; the discal cell is broad at apex, and has a small appendicular vein from its lower corner ; the lower vein of 2nd posterior cell meets the discal cross vein just below the middle, and has a slight appendix into discal cell ; halteres yellowish, base of the club dark.

I have nine specimens, including both sexes, from Simla, which exactly agree with Walker's type.

E. bengalensis is quite distinct, but I have not seen a specimen of *brahma.*

Exoprosopa abrogata, n. sp.

♂. Head ; frons at level of antennæ $\frac{1}{3}$ the width of head, at vertex about half this width ; face and frons rufo-testaceous, covered with yellowish white scales, with a few short blackish hairs ; antennæ red, 1st and 2nd joints with a few black hairs, 3rd joint rather short, gradually tapering, excluding style about $1\frac{1}{2}$

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times as long as 1st and 2nd together, style about $\frac{2}{3}$ the length of the joint, thicker at apex than at base ; facial bump rather prominent, viewed in profile about $\frac{2}{3}$ the short diameter of the eye ; proboscis rufo-testaceous ; occiput rather wide, covered with greyish scales, the ground colour immediately behind the eyes darker than the posterior margin.

Thorax blackish on disc, covered with greyish scales ; pronotum with a collar of light yellow hairs ; scutellum dark red ; bristles on postalar calli and scutellum yellowish. Abdomen both above and below light red, the segments more or less blackish at base, covered with grey scales (partially denuded) ; 1st segment with a tuft of light yellow hairs at each side.

Legs rufo-testaceous, with some indications of grey scales on femora and tibiæ ; all femora and tibiæ with very short black spinules ; apical 2 or 3 joints of tarsi darkened.

Wings with the anterior portion as far as the end of 1st longitudinal vein tawny yellow ; all cross veins and the apex of discal cell with dark tawny suffusions, and there are similar but smaller suffusions near the apex of both branches of the 2nd longitudinal vein ; 1st posterior and anal cells open. The third posterior cell is divided by a veinlet which runs towards the apex of discal cell (both my specimens are alike in this respect, but it may be adventitious); base of costa with greyish scales and short black bristly hairs ; halteres yellowish white.

Length 8 mm.

Described from two specimens obtained at Deesa in February.

Nearest to *auriplura*, Walk., but differs as follows : smaller, antennæ red, not black, 3rd joint much shorter than in *auripura*. In the latter species the whole of the wings are tawny yellow ; in the present species the apical and posterior margins are, except for the suffusions on the veins, almost hyaline.

Exoprosopa dissoluta, n. sp.

♀. Head ; frons at level of antennæ about $\frac{2}{5}$ the width of head, narrowing at vertex to $\frac{1}{5}$ the width at antennæ ; face slightly convex, viewed in profile the upper mouth edge extends beyond the eye margin about half the short diameter of the eye ; vertex and frons reddish brown, becoming paler towards antennæ, below which the whole face and mouth edge is pale testaceous ; frons with some short stiff black hairs, and covered with pale yellow scales, which extend to the mouth edge ; antennæ with 1st joint red, with numerous short stiff black hairs, 2nd and 3rd joints brown or blackish, 3rd gradually tapering, longer than the 1st and 2nd together, style short ; proboscis black, palpi pale ; occiput rather broad, black with some pale yellow scales, the indentation of the eyes with white scales; occipital fringe short, whitish.

Thorax black, with portions of metapleuræ and sternopleuræ red ; pronotum with a collar of pale yellowish scale like hairs ; disc covered with short yellowish scales, among which are mixed a few short stiff black hairs ; patches of greyish white scale-like hairs above and below bases of wings ; bristles near wing base and on postalar calli black ; scutellum dark red, covered with scales like the thorax, and with black marginal bristles.

Abdomen black, apical margins of segments narrowly reddish ; 1st segment with a patch of greyish scale-like hairs at each side, 2nd and following segments with basal bands of white scales, on the first three or four segments these bands cover about half the segment, those on the apical segments being wider ; last two segments fringed with black hairs ; venter almost entirely covered with short greyish scales, which become yellower towards apex of abdomen.

Legs ; front coxæ red, covered with long grey hairs and a few stiffer black ones ; remainder of legs brownish or blackish, with small black spinules on intermediate and hind femora and tibiæ.

Wings ; base as far as humeral cross vein dark brown ; an irregular infuscated band stretches from fore margin through discal cell and apex of anal cell, becoming

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narrower posteriorly, and hardly reaching hind margin of wing ; the infuscation is more pronounced round all the cross veins ; the discal cell has a small sub-hyaline spot near base, and another larger one near apex ; 1st posterior and anal cells open ; base of costa with some whitish scales and short black bristles ; halteres pale.

♂ Similar, except as follows : frons slightly narrower, covered with snow-white scales ; style of antennæ longer, red ; occiput narrower ; abdomen red, 1st and 2nd segments with broad basal triangular patches black ; genitalia fringed with soft red hairs.

Length 13-14 mm.

Described from 1 ♂ and 5 ♀♀ from Quetta, mostly in good condition. The ♂ however has the abdomen somewhat denuded and has lost one wing.

This is very near to *E. undans*, Walk., of which the locality is unknown. It differs as follows : the bands of white scales on the abdomen are broader in the present species, and more distinct ; the ground colour of the abdomen is darker, at any rate in the ♀ ; the neuration is similar, except that *undans* has a slight appendicular vein from lower corner of discal cell. The wing markings in the present species are very similar to those in *undans*, but they are darker, and all my specimens have the cross vein connecting the lower branch of the 2nd longitudinal vein with the 3rd infuscated, whereas this vein is clear in *undans*. The type and only specimen of *undans* is headless, so no comparison as regards the head is possible.

Both Major Austen and Mr.Collin, who happened to be at the British Museum when I was comparing my specimens with Walker's type of *undans*, consider the present species distinct, otherwise I should have hesitated to describe it.

Exoprosopa iridipennis, n. sp.

♂ Head with the eyes almost touching at vertex, but the frons at level of antennæ quite ⅓ the width of head ; frons and face nearly to upper mouth edge black, becoming much lighter at mouth edge ; frons with thick black pubescence down to the antennæ, and some purple scales both above and below antennæ ; proboscis rather long, blackish ; palpi thin, covered with bristle-like hairs : antennæ black, 1st and 2nd joints thickly covered with long black hairs, 3rd joint bare, tapering, style about half as long as joint, with a minute terminal bristle ; occiput with short greyish pubescence, and some purple scales.

Thorax black ; pronotum and sides thickly covered with rather long bright golden hairs ; dorsum covered with iridescent purplish blue scales, and with patches of snow-white scaly hairs near wing base ; below there are patches of similar hairs on the sternopleuræ, no conspicuous bristles at base of wings or on postalar calli ; scutellum brownish, with some purple scales at base, and numerous rather short black bristles along its apical margin.

Abdomen black, covered with highly iridescent purple-blue scales ; 1st segment with a patch of whitish hairs at sides ; 3rd segment with a large oval patch of snow-white depressed scales on each side, extending over the side margins, and indications of a much smaller patch of similar scales on extreme sides of 6th segment ; remainder of the pubescence black, except that there is on the posterior margins of the last two segments an admixture of scaly white hairs ; venter with the ground colour black ; 2nd segment with a triangular patch of snow-white scales, the apex of the triangle being at apical margin ; 3rd segment almost entirely covered by similar scales, 4th with similar scales at apex ; the black part of the venter is, like the dorsal portion of abdomen, covered with iridescent purple blue scales.

Legs black ; all coxæ covered with rather long greyish pubescence ; intermediate and posterior femora and tibiæ with very short spinules.

Wings hyaline and highly iridescent ; yellowish at base and in costal and subcostal cells; base of costa and all the nervures testaceous ; costa at base with very

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short black bristly hairs mixed with white scales ; squamæ whitish, with moderately long white fringe ; halteres yellow ; the 1st posterior cell is unusually wide at apex.

♀. Similar ; the distance between the eyes at vertex about $\frac{1}{10}$ the width of head ; the white scales on abdomen, both above and below, less apparent. possibly because the specimen is somewhat rubbed.

Length 13-14 mm.

Deesa ; one specimen of each sex.

This belongs to the group of *E. hetrusca* Fab., and is nearest to *E. vitreicosta*, Walk., described from a headless type in poor condition. The present species is considerably larger, and the colour of the iridescent scales on the black portion is bluish-purple ; in *vitreicosta* they are distinctly of a bronzy black ; the type of *vitreicosta* has hardly indications of white scales on the abdomen.

Exoprosopa punjabensis, n. sp.

♂. Head; frons at level of antennæ about $\frac{1}{3}$ the width of head, lessening to $\frac{1}{3}$ of that width at vertex ; black above, paler below, almost white along mouth edges ; frons covered with yellowish white scales, mixed with short black hairs; face with yellowish white scales ; facial bump rather small, about $\frac{1}{3}$ the short diameter of the eye ; antennæ black, 1st and 2nd joints with black hairs, 3rd gradually tapering, longer than the 1st and 2nd together, style short; occiput rather broad, with snow-white scales.

Thorax black ; pronotum with a collar of greyish hairs ; dorsum covered with long yellowish grey scales ; sides and below with long white hairs ; scutellum with long yellowish grey scales ; bristles at base of wings, on postalar calli, and on margin of scutellum black.

Abdomen black ; 1st segment and the bases of the remaining segments thickly covered with yellowish grey scales ; apical margins of all the segments except the first covered with black scales. which are mixed with longer black hairs on the last two segments; venter with the apical margins of segments broadly covered with long white scaly hairs; sides of 1st and 2nd segments with rather long grey hairs ; genitalia reddish.

Legs black ; femora with grey scales.

Wings rather short, hyaline and iridescent ; base and costal margin very pale yellowish ; all the nervures testaceous ; 1st posterior and anal cells wide open, 2nd posterior cell rather wider at apex than at base; base of costa with yellowish grey scales, mixed with short black bristly hairs ; halteres very pale testaceous.

Length 10-12 mm.

Described from 3 specimens from Ferozepore, Punjab.

Very near *E. vitrea*, Big., but there are no bright yellow hairs on either thorax or abdomen in the present species, and all the abdominal segments except the first have entire black apical bands ; from *viteipennis*, Brun., it differs in the antennæ being black, and all the wing veins testaceous.

This species, with its banded abdomen, bears a strong superficial resemblance to one or two small species of *Andrena* which occur in the same locality. When I captured my specimens I was chiefly interested in *Hymenoptera*, and thought I had caught bees until I examined them.

Exoprosopa auriplura, Walk.

By a misprint on page 212. Diptera Brachycera, Vol. I, this name is given as *auriplena*.

Exoprosopa basifascia, Walk.

E. semilucida, Walk., should be sunk as a synonym of this species. The types of both are in the British Museum, and I can see no difference between them, not in Walker's descriptions.

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Exoprosopa disrupta, Walk.

Entomologist, 1871, p. 261.

There is a specimen of this species in the B. M., labelled "Ind." My own specimens are from Lahej near Aden, and it requires confirmation as Indian. The following abridged description should enable the species to be recognised.

♂ ♀. Black; lower part of frons, antennæ, and mouth edge red; face and frons with short black hairs and white scales; occiput with sparse white scales; pronotal collar pale yellow, dorsum of thorax with yellowish white scales, sides with longer grey scales; scutellum and abdomen more or less covered with grey scales, forming bands (often denuded) at the base of abdominal segments, which bands are usually most conspicuous on the 3rd and 5th segments; abdomen of the ♂ more or less dark red; femora and tibiæ reddish; wings with dark baso-costal bands and all the veins, but more especially the cross veins, broadly suffused.

Length 8-13 mm.

(*to be continued.*)

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THE SNARE OF THE GIANT WOOD SPIDER (*NEPHILA MACULATA*)

BY

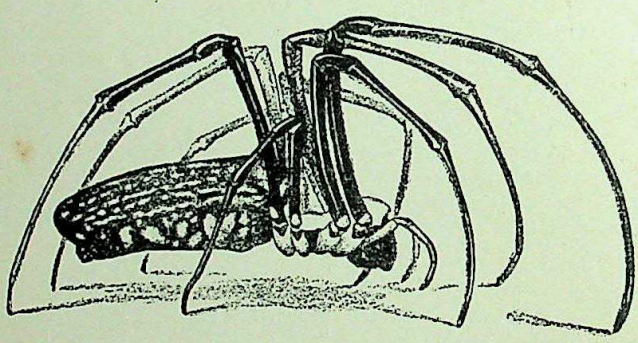
CAPTAIN R. W. G. HINGSTON, I.M.S.

PART I.

(*With 2 text figures*).

Some of my earliest observations in natural science were given to the wonderful work of the spiders that weave geometrical snares. It was in a beautiful and secluded valley of the Himalaya, and the spider which disclosed the secrets of the architecture was the humble and insignificant species, the *Araneus nauticus*.*

Eight years have passed since these investigations were made, and many a time have I reviewed the work and followed the stages of the architecture again. Often of an evening, when chance has offered, I have watched the exquisite fabric assume its geometrical beauty and shape; I have noticed how the different species possesses each its own special peculiarities and ways, yet for a long time I met with none which made any wide or important deviation from the main principles originally observed. But fortune in the end will always favour those who watch and wait. At length the time arrived when another of the Epeiridae displayed her workmanship, and revealed a succession of varied secrets that satisfied my highest hopes.



Giant Wood Spider (*N. maculata*).

(From the Fauna of British India (Arachnida).

The species is none other than the *Nephila maculata*; in this vast country the most handsome and most powerful of its kind.

How very different from the insignificant *Araneus* is this great conspicuous giant of the woods. The *Araneus* is a small and globular spider, a little brown species with stumpy legs, only one quarter to one half an inch in length. The *Nephila* is an elongated monster, variegated in brilliant colour, with long and slender limbs and four to six times as large. Equally wide is the difference between their snares. Both are of the same geometrical pattern; but that of the *Araneus* is a fragile structure, on an average some ten to twelve inches in width; while the *Nephila* spreads out a strong sheet of silk with a diameter of five feet. I found the *Araneus* over the streams and pools that nestle amidst the rocky glens. I come on the *Nephila* in more gloomy haunts. She is a resident of the dense and leafy jungle, a true inhabitant of the woods.

I must briefly describe the splendid architect herself. It is of course the female which is responsible for the work. In front her head and thorax are welded

* The architecture has been fully described in "A Naturalist in Himalaya."

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into a quadrangular mass. It is clothed above in a pale yellow velvet, and armed in front with a pair of black massive jaws. Alongside the jaws are the hairy palpi. Each is bright yellow in its proximal half, while the remainder is a dense black. Behind the thorax is the ponderous abdomen shaped like a truncated cone. The base is in front, vertical and abrupt, and connected with the thorax by a narrow moveable hinge. Behind it terminates in a blunt round point, and beneath the tip is a reddish prominence which supports the compact cluster of the spinnerets. The abdomen is strikingly decorated with a pattern of spots and lines. Its general colour is a dense black relieved beneath by a reddish tinge and a diversity of yellow spots. On either side of the cone the markings are more delicately laid. They consists of five longitudinal streaks of pale yellowish wavy lines. On its upper surface the abdomen is more vividly adorned. A pair of bright longitudinal orange bands traverses it throughout its length, while in front are three broad transverse stripes of which two are brilliant orange and the intermediate one is black. The legs are extraordinarily long and slender, the fore leg being no less than three inches in length. All are black in colour with a yellow spot beneath the joints. They are clothed in delicate hairs and spines, and terminate in minute claws. Such is the largest of our Indian spiders. It has a span of six and a half inches, and its body is one and a half inches in length.

The magnificent snare of this great spider can be spun only in some special site. In diameter it is almost the height of a man; and consequently a clear wide space is necessary for the expansion of so immense a net. The spider knows well the most suitable place. It spreads it across some open clearing between the branches of the forest trees. It often selects a pathway or a shady water course, or it finds a tunnel in the tangled growth where the insects pass to and fro. Frequently it secures it above to the branches, and anchors it below by silken filaments to the low-lying foliage on the ground. It is only in these secluded spots that we find this marvellous sheet. There is no work of architecture more worthy of our note. It is so delicate, so beautiful, so immense; it has such a wonderful appearance of exactitude and of geometrical precision in all its parts. It is like a great transparent wheel, spread out as an invisible barrier and stretched tight between the forest trees.

Given the favourable opportunity, we can witness no more fascinating work than the great *Nephila* at the architecture of her snare. She teaches us many detailed truths which the little *Araneus* could never show. She is of such size and bulk that all her complex movements are magnified to a much larger scale. Moreover she is so deliberate in every motion; she performs every act so slowly, so decidedly and with such a movement of determination and precision that it is easy to follow the geometrical principles that underlie the intricate architecture of the snare. She thus yields more to observation than does the small and hasty *Araneus*, and I will endeavour to tell the additional facts she has disclosed.

Though permitting of close observation, nevertheless she is timid and shy. At the slightest touch on her snare she immediately dashes away to the margin, and waits there till the danger has passed. She will work only in quietness and solitude and under cover of the darkness of night. It needs much patience and a quiet search to see this architect at her toil. None have tried my patience higher; none have rewarded it more.

I now turn to the workmanship, and I ask the reader's permission to repeat what I have elsewhere described. I must state again the essential features in the construction of the ordinary geometrical snare, for, unless the normal process is borne in mind, it will not be possible to realize the new lessons which the *Nephila* has to tell. Let us therefore first consider the ordinary geometrical snare. It is fashioned in this way.

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The hour of work is at hand, and the spider is isolated on a blade of grass standing in a narrow stream. "The first essentials are some foundation-lines to serve as a framework for the snare. The spider begins. It climbs to the tip of the blade of grass; it elevates its abdomen and from the spinnerets emits a silken filament to the wind. The light filament is wafted to the shore, becomes entangled in another blade of grass, and the first foundation-line is in place. Backwards and forwards runs the spider along its line, adding each time a new filament, doubling, trebling, quadrupling the line until it is strong and sound. The first foundation-line is secure. For the second foundation-line the spider adopts a different procedure. It takes its stand about midway on the first line and suddenly drops down suspended on a filament of silk. Perhaps it finds an attachment. If not, it climbs up again and drops down from another point. At length it meets a blade of grass and anchors its second line. By joining these points together with a filament of silk a triangle is formed of three foundation-lines, the simplest form of framework to support a geometrical snare. The spider reinforces these lines with additional filaments until it is satisfied with the strength of the scaffold. This is the first and elemental stage; the construction of the foundation-lines.

I now come to the second step in the architecture. A triangular framework is in position or if suitable connections can be found, a trapezoid figure is more to the spider's choice. Whatever its shape, the spider next proceeds to construct the radii. These are the spokes of a wheel that diverge from a common centre to end at the foundation-lines. The spider constructs them with little trouble. It first runs a line from side to side across the framework. Then, selecting a point on that line which will be the future centre of the snare, it carries a number of lines from that central point to the circumference of the snare. In this way it completes a series of radii, each equidistant from its adjoining radius. Each radius is in accurate position; all diverge equally from the common point. The second stage is mathematically complete.

Now comes the third stage, the construction of a hub. The snare in its present state resembles a wheel. It has a centre, radiating spokes, and a rim formed of its foundation-lines. The spokes need some strengthening at the point where they leave the centre, the wheel requires a hub. This the spider proceeds to make. It winds five turns of a slender filament around and close to the central point, attaching the filament to every spoke. A hub is thus added to the wheel; the spokes are bound together at their inner ends and the third stage is complete.

The fourth step in the work is the formation of a temporary spiral. This adds a further strength to the snare, holding the radii still more firmly in place. The spider takes four turns round the hub, stepping from radius to radius and attaching the filament every time it passes a spoke. A spiral of four turns, like the hair-spring of a watch, is thus wound about the centre. All the turns are parallel, all accurately placed. The work is perfect and precise. This is the fourth stage in the architecture, the construction of the temporary spiral.

The spider now reaches the fifth and most important step in its work, the formation of the viscid spiral. It proceeds to the outer margin of its snare close to where a radius joins a foundation-line. It now commences to wind another and much longer spiral round and round the snare, commencing at the circumference, working towards the centre and attaching the spiral at every spoke. To pass from radius to radius it uses the temporary spiral as a bridge. Now this viscid spiral is the vital element of the snare. It is continuous in closely parallel lines from the circumference to the very centre. It is covered with a highly viscid fluid, while all the other lines, the radii, the hub, the temporary spiral are non-adherent to the touch. It is that part of the fabric that has the power of capture. The formation of the viscid spiral is a laborious task; it occupies the spider more time than all the rest of the snare. It is a fine

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and subtle filament, often continuous from end to end. Every line is parallel, and the whole is a wonderful work of mathematical beauty and precision. The spider at length completes its viscid spiral. It anchors the end close to the centre, and the snare is finished.

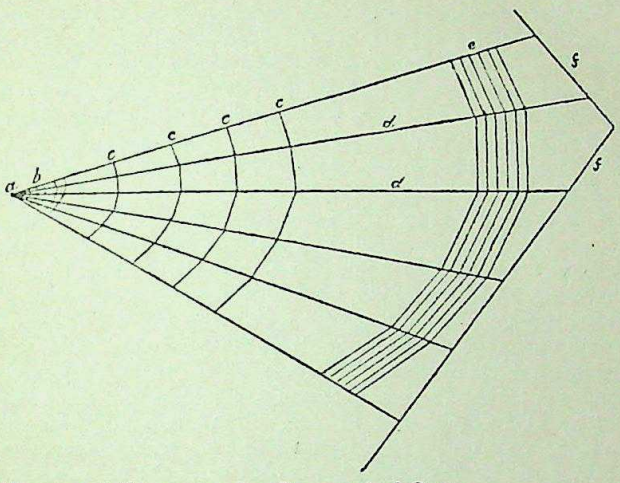

Fig. 1 Diagram of the parts of a Geometrical Snare.

(*a*) Centre. (*d*) Radius.
(*b*) Hub. (*e*) Viscid spiral.
(*c*) Temporary spiral. (*f*) Foundation line.

Such is the construction of the geometrical snare, a work of the most marvelous texture. There are five successive stages in its architecture (see Fig. I.).

1. The foundation-lines.
2. The radii.
3. The hub.
4. The temporary spiral.
5. The viscid spiral."

Bearing these main principles in mind , let us now inspect the work of the *Nephila* ; let us see how she varies from the common mode of workmanship, let us consider the additional lessons which I find she is able to teach.

Armed with patience and a lantern, we move out into the jungle by night. We pass to some dark secluded spot chosen by the spider for her snare. Earlier in the morning we cut away the structure leaving a few foundation-lines in place. All day long the *Nephila* has been hanging to a broken thread. She will not think of work until some hours after the sun has set. We sit down with the light near the fragments of the old snare. We prepare for a long and patient wait. In all likelihood it will end in failure ; for the *Nephila* will often resent our interference ; if so, then she will scramble away into the foliage and seek for some more welcome nook elsewhere. But we wait in the hope that she will reconstruct her architecture in the place where we have cut it away.

The weary hours drag on the lamp flickers at our side ; later the moon sheds a faint gleam of light, and we are filled with a sense of solitude and wonder, a veneration for the great unknown. We hear the chuckles and the hootings of the birds of night, the trumpet of the sambhar, the growl of the leopard, the roar of the king of Indian jungles that reverberates through the peaceful woods. We see the ghostly shapes of the forest trees, the deep dark spaces beneath their dripping boughs, and we feel the awe-inspiring influence of nature in the dark and lonely silence of the night. But we must watch and wait alone. None would join us in a midnight sitting merely to contemplate a spider at her work.

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We persist. At length we are rewarded; the *Nephila* begins to move. She at last takes up the first thread of her wonderful work. Let us follow the successive stages of her architecture and observe what she has to show.

She thoroughly explores the vicinity, wandering about the branches, searching everywhere with her long legs until in the end she satisfies herself that the place is suitable for work. Then she begins at her old foundation-lines, strengthening and repairing the injured framework so as to make it suitable to enclose the snare. She hangs back-downward from her lines; she climbs backwards and forwards along them; she doubles, trebles, and still further reinforces them until they are sufficiently firm and strong. With her slender limbs she sweeps the air as she slowly climbs along her threads. In this way she searches for suitable attachments. The act is very deliberate and precise. First she suspends herself by the legs of the right side and with the left ones she sweeps the air. Then she reverses the process. The left legs become the organs of suspension and those on the right side commence to explore.

We can learn a few little facts even in this early stage. We can observe that the spider's non-viscid thread, though apparently only a single filament, is really composed of a number of strands fused into one line. Owing to the large size of the spider we are able to detect this. The cluster of three, or perhaps four, filaments can be seen to emerge from the spinnerets, and to blend into a single thread about an inch or less away. Sometimes they will remain for a distance of two or three inches as separate and independent lines.

Another little point that we cannot but observe is the mode of fixation of the line. It is by no means just a simple touch with the spinnerets. This great spider shows us that it is a very definite and decided act. The spinnerets are first pressed against the point of anchorage, then the abdomen is rocked firmly from side to side; a small quantity of viscid matter is squeezed out from the spinnerets, and this glues the non-viscid line in place. We inspect carefully the point of fixation and we see a tiny white flake of glutinous material; it is the substance by means of which the attachment has been made.

A third fact easy to corroborate is that on all occasions a strain is necessary in order to draw the filament from the spinnerets. The spider has no power to emit it by muscular force. Indeed, on occasions, she may sometimes move a little backwards, and then the filament hangs loose owing to the loss of the external strain. The line is always drawn from the belly of the spider by some traction from the outside. She is incapable either of drawing in or of shooting forth her own slender thread.

We now come to the next act in the architecture, namely the drop which the spider makes in order to fix her first vertical line. She falls, seeking an attachment below, and allows herself to swing at the end of her almost invisible thread. But the point to be observed is this. The spider does not swing in such a way as to permit a strain on her spinnerets. Indeed such a mode of suspension would be impossible. It would result in the line continually running out. The spider prevents this by stretching up one hind leg and hooking the terminal claws over the suspension line. The claws there act as a check; it is they which take the weight and strain, and they prevent the suspension line from running free from the spinnerets. Nor are the other legs idle while the spider is swinging from her line. She spreads them wide apart; they grope around and search the air. They are waved about in all directions, and, since they cover an expanse of over six inches in diameter, they supply the spider with an excellent means of finding a point for the fixation of her thread. Should the spider fail to secure an attachment, she will again climb up her line. Her mode of ascent is thus. She has been swinging head downwards holding her filament with a hind claw. She now turns about. She ascends by a hand over hand motion, employing the claws of all the three front pairs of legs to haul her up the thread. But the ascent is a wasteful mechanism for the spider, the

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slack line which is drawn down cannot again be absorbed into the spinnerets and is thus permanently lost.

As was observed in the case of the foundation-lines, so also is the single filament of suspension formed by the fusion of a number of threads. They can be seen escaping in a delicate cluster from the very front of the spinnerets. Now occasionally, while the *Nephila* is suspended in the air, she gives forth another filament which she permits to float away upon the breeze. She has failed to find an attachment with her long and raking limbs, and now she begins to search the air by the aid of an extensive line. But let us observe the act in a little detail. We will first detect the fact that the line given to the wind escapes from the posterior spinnerets, while the suspension line emerges from those in front. Excellent arrangement. The line given to the wind must float away behind the spider. Did it not come from the hindmost spinnerets then it would get entangled in the suspension line. But there is another point. The flotation line, that is the one given to the wind, is, like the suspension line, not a single but a complex thread. Yet its composition is the exact reverse of the suspension line. It emerges as a single filament and ends in a cluster of threads. This terminal brush is the aerial support which permits it to float freely on the breeze. This little fact I have elsewhere described. The new point revealed by the *Nephila* is that the spider can emit at the same moment two lines constructed on a reverse plan. The one is from the front of her spinning wheel; it is a fixed suspension line composed of a cluster of strands which fuse into a single thread. The other escapes from the hindmost spinnerets; it is a free flotation line consisting of a single filament which terminates in a sheaf of threads. What a wonderful and efficient spinning apparatus to produce such diverse work as this!

I pass now to the next stage in the architecture, the method by which the radii are distributed through the snare. Remember first the work of the *Araneus*. She spreads abroad her radiating spokes, about twenty in a moderate snare. They are all equidistant; they all diverge evenly from a common centre; they form a perfect and symmetrical wheel. Now let us follow the *Nephila*, and see how she varies from the common plan. Like the *Araneus* she lays her radii haphazard; a few on one side, then a few on the other, without working on any apparent scheme. The *Araneus* fixes her radii in this manner. She climbs out along one radius paying out her filament behind her; she reaches the foundation-line; she takes four paces along that line there she halts, draws tight her filament, secures it to the foundation line, and her radius is in place. She then climbs back along this new radius, anchors her thread at the centre, and thus duplicates her spoke. Now, in what way does the *Nephila* act? She also climbs out from the centre to the circumference, but in the first half of the journey she clings to a pair of radii; then she drops one of the two, and in the same way as the *Araneus* continues her climb to the end. An essential difference now occurs. She does not, like the *Araneus*, move forward four paces, fix her line, and then climb back again along it. She advances a distance of one inch, anchors her filament, and the radius is in place. But she does not halt here and return to the centre. She makes a second advance over an equal distance. Then she again fixes a line. This done, she climbs back along an adjoining radius, and at its inner end she attaches her thread. Thus, as a result of the return journey, a second radius in in place. This is therefore a very different mechanism from that employed in the ordinary snare. The *Araneus* at each journey to and from the centre lays out only one radius, but, since she climbs back along her new spoke, she manufactures it of double strength. The *Nephila* in the same journey constructs two radii, but since she returns along an adjoining radius, therefore each consists of only a single line.

Now for another difference. All the radii in the snare of the *Araneus* diverge evenly from the centre in the same way as a series of spokes radiate from the hub of a wheel. It is otherwise in the architecture of the *Nephila*. She supplies

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her snare with a system of branching spokes. All her radii are not, as in the snare of the *Araneus*, clear straight lines undivided from end to end. On the contrary, many of them after a greater or less distance break into two, and thus reach the circumference as a pair of spokes. Let us investigate how this is done. The *Nephila*, unlike the *Araneus*, does not first complete her radii before commencing at her temporary spiral. Both stages occupy her at the same time. Now she lays out a few radii, now she takes a few turns at the spiral, then she resumes the radii again. Furthermore, while constructing her radii, she does not work from the centre, but rather from the last turn of the temporary spiral which she has laid down. If this statement is clear, then it should be obvious that, on the spider's return journey after fixing one end of the second radius at the circumference, she does not continue all the way to the centre, but halts at the outermost turn of the temporary spiral and there anchors her thread. Thus at the point where the radius and the temporary spiral meet there the radius will appear to divide. As a consequence of this peculiar mechanism the radii are seen to branch in all parts of the snare. Some divide near the centre, others near the circumference, and the point of division is always where a radius and a spiral meet. Thus we cannot count the number of the radii. at least the number will be much less near the centre than near the circumference of the snare. An idea of this branching will be gained by making the circular count. An inch from the centre they number 28 ; four inches from the centre they are 80, and at the circumference 112. Indeed it is clear that, in a strict sense, they are not radii or spokes at all.

I pass now to explain why these peculiarities exist, since there is always a good reason for everything we see. The great increase in the number of the radii depends of course on the immensity of the snare. They are the scaffolding of the architecture and must support it at every point. Twenty are sufficient for the little web of the *Araneus* ; over a hundred are required for the *Nephila's* sheet. Moreover the radii are much closer together than they are in the ordinary snare. This likewise depends on the vast area of the sheet. Compare it with a mechanical wheel. A small wheel can be made with only a few and widely-separated spokes ; they are sufficient to give it rigidity and strength. But increase the circumference, and many more must be provided, and they must not be far apart. The rim must be supported at many and closely-connected points, otherwise the structure will collapse. The mechanism is essentially the same in our comparison between the two snares.

At each journey the *Nephila* completes two radii, while the *Araneus* manufactures only one. This deviation has a value ; it makes for economy in the architecture, an economy not only in time, but, since each radius is a single thread, an economy also in the expenditure of silk. The saving of time must be of some importance,since the laying of the radii is a tedious work, and a much more prolonged operation than in the case of the ordinary snare. So also is it a service to the spider not to waste her precious silk, especially in so immense a snare which contains such a multitude of lines. Possibly the strength of the architecture is diminished by the confinement of each radius to a single thread. But compensation is made for this by the great increase in the number of the spokes.

The employment of branched instead of unbroken radii is another ingenious method of securing economy in material and of adapting the system of radiating spokes to the extensive area of the snare. Indeed, without the adoption of some such mechanism, it would, I think, be quite impossible for the spider to extend so wide a sheet. She may be an inimitable architect. But it is beyond even her constructive powers to lay out over a hundred lines that diverge equally from a common point. At the point of divergence they would be so massed and crowded that the spider would be utterly unable to manipulate the individual threads. She could never separately distinguish them nor

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distribute them evenly over the surface of her snare. Furthermore she would waste her material by collecting so large a number of radii all at one central point. She would only unnecessarily overburden that portion of her architecture by placing there an excessive number of radii where a few would give sufficient strength. By making use of a branching system she obviates these defects. She adapts her architecture to the immensity of her snare. She simplifies her work ; she saves her material ; she more evenly distributes the strength of her scaffold ; she economizes her valuable time.

The next point that needs consideration is the method by which the *Nephila* measures the distance between her spokes. For only by some geometrical operation could she produce so exact a work. The *Araneus*, I have said, performs the act in this way. She climbs out along a radius; she reaches the foundation-line; she takes four paces along it; and then affixes her thread. It is by the advance of four paces that she measures the interval between her spokes. By keeping strictly to this number she spreads her radii evenly through her snare.

Now this method will not suit the *Nephila*. If she made four paces between each pair of radii, then her spokes would be very widely spread, while it is essential that they should lie not far apart in order to support so large a wheel. She must adopt some other method, and this is how she gains her end. She moves out along the radius ; she reaches the foundation-line ; she advances along it. So far it is the same as the *Araneus*. But watch her hind leg. The claws at the tip are hooked over the radius along which she has just climbed out. She advances, but she does not release her clutch on the radius. As a consequence her hind leg becomes stretched tightly behind her. When this happens she lowers her spinnerets, anchors her filament, and secures a new spoke. She has measured off the distance for her first radius; it is the interval between her spinnerets and the tip of her hind leg. She now releases her hold. She again advances and hooks the same hind claws over the radius that she has just laid. She continues to advance until her leg is again outstretched in the same position as before. Once more she anchors her filament and the second radius is measured off. In this way she continues all round the snare, at every journey measuring a pair of spokes. All her radii are evenly separated at the circumference, and the distance between the spinnerets and the tip of the hind leg is the simple measuring-rule employed.

In this manner are the radii secured. I have tried to explain the various deviations, and to show the essential importance of each to the particular character of the snare. This laying of the radii is a wonderful sight. I know of no more striking architecture of its kind. Imagine, it is midnight in the silent woods. Before us is a great vertical wheel with a diameter as tall as a man. It is supplied with a hundred spokes, transparent, slender rays of silk which sparkle where we shine the light. Yet so delicate, they are all firm and strong ; yet so numerous, they are all geometrically exact; and they are spread abroad with perfect uniformity over all this immense sheet. Amidst them moves the great architect herself. She looks at first sight an unwieldy creature, groping aimlessly and fruitlessly with her limbs, and scrambling out over the invisible sheet as though she were climbing unsupported in the air. But it is not so. She is a marvellous and consummate architect. She works with a perfect regularity and precision; she weaves with an inimitable skill. Every movement of her widespread limbs has a definite act in view. They are now feeling, now testing, now touching, now measuring ; they are building the most fascinating work of architecture that I have ever had the privilege to see.

Let us pause. The construction of the radii is more than sufficient to engage our attention here. In the next chapter we will follow to its final completion the architecture of this geometrical snare.

(*to be continued.*)

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"THE BIRDS OF MESOPOTAMIA."

BY

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ASSISTED BY

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AND

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PART III.

(*With 2 plates.*)

Continued from page 427 of this Volume.

190. White Pelican. Pelecanus onocrotalus.

1. *Pelecanus onocrotalus onocrotalus.* L. (Syst. Nat., 1758, p. 132—Africa)
2. *Pelecanus onocrotalus roseus,* Gm. (Syst. Nat. 1, p. 570, 1788—Manila)

191. Dalmatian Pelican. Pelecanus crispus.

Pelecanus crispus, Bruch (Isis., 1832 p. 1109—Dalmatia).

The information to hand about Pelicans is not at all satisfactory and fails to clear up the status of these birds. White Pelicans appear to be common. Magrath noted thousands on the Suweikieh marsh in August and says they had quite small young with them. Elsewhere on the inundations huge flocks are to be seen from time to time as the state of the water is favourable or otherwise, as at Kut, Nukta, Amara, near Baghdad, etc., and nearly all records relate to the months of November to April while Pitman noted a migratory movement at the end of February, flocks then travelling north, and he says that Pelicans were absent from the Baghdad floods from April 23rd to the end of July.

Of the Dalmatian Pelican we have but few records ; it was noted by Pitman at Fao and Amara in winter and seen occasionally at Tekrit by Logan Home also in winter ; Zarudny gives it as a winter visitor.

Pelicans breed near Fao whence Cumming sent to the British Museum a number of specimens, chicks and eggs. These specimens Mr. Kinnear has kindly hunted up for me and examined ; of *roseus* there are three immature specimens and an adult, the latter is dated October 24th, 1886, the others bear no date ; of *onocrotalus,* there are two adults and two immature birds, one in December, the rest bear no date. There are two feathering chicks ; in the *onocrotalus-roseus* group the feathering on the forehead ends in a point, in the *crispus-philippinensis* group the feathering ends in a concave margin and judging by this Mr. Kinnear says these chicks are those of *crispus.* In the Ibis, 1891, p. 116, Sharpe referred an adult head, eggs and apparently these chicks (dated October 24th, 1886) to *mitratus* (= *onocrotalus*).

Whether both species breed in Mesopotamia is a matter which requires future investigation as does the status of all three birds, and breeding specimens are desirable.

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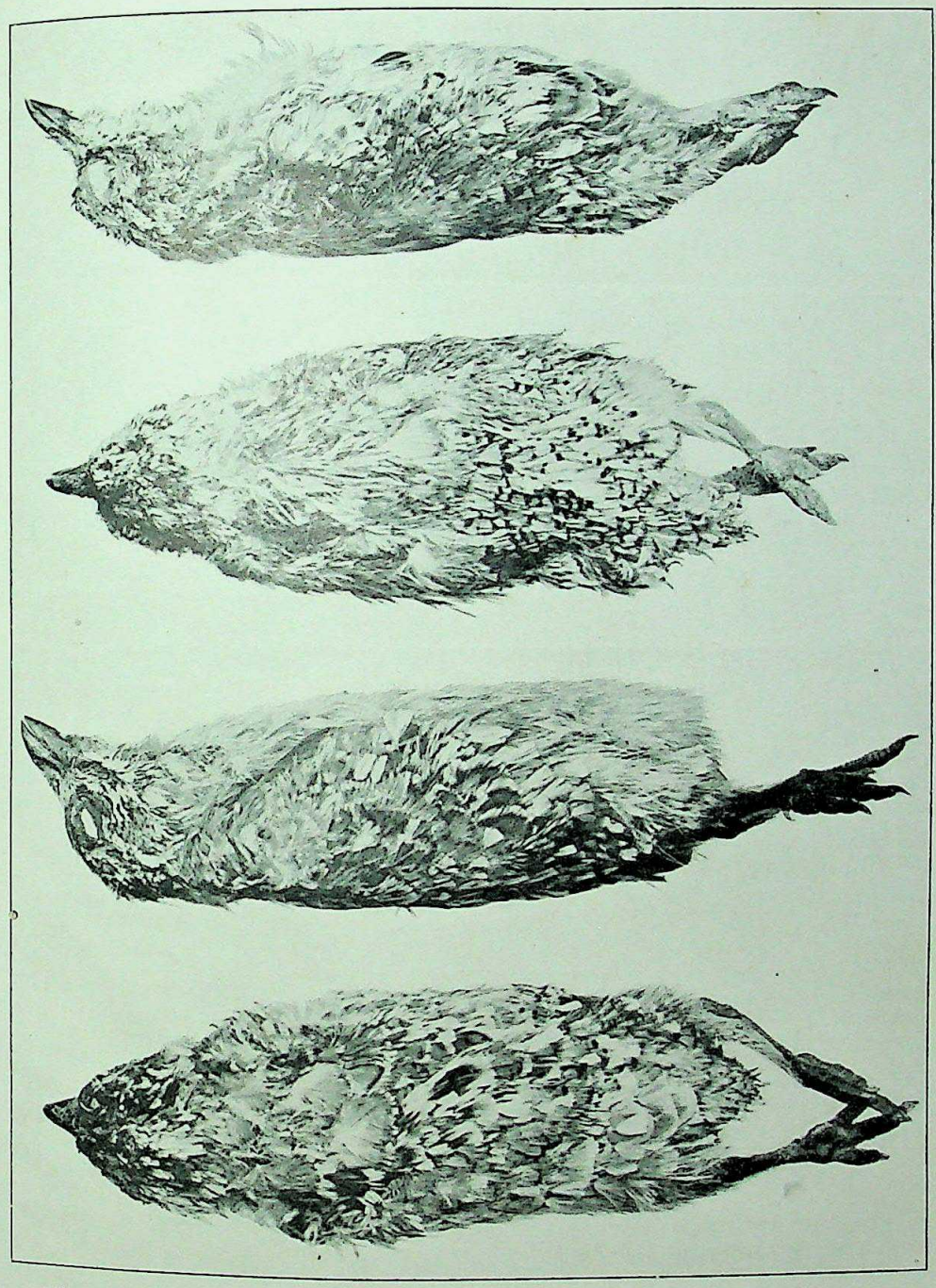

CHICK OF LARGE PINTAILED SANDGROUSE
(*Pterocles alchata caudacuta*)

CHICK OF SPOTTED SANDGROUSE
(*Pterocles senegallus*)

N.B.—Both about the same age; note smaller, weaker bill, smaller feet and paler colour scheme of *senegallus*.

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192. Cormorant. Phalacrocorax carbo.

Phalacrocorax carbo subcormoranus (Brehm). (Ornis, I, p. 42, 1824—Holland).

The Cormorant is a not uncommon winter visitor to the rivers and deeper floods or lakes, from Tekrit and Ramadi to Fao ; it is recorded from October to May, on the 18th of which month Buxton saw a few on the Hamar Lake, but found no evidence of its breeding there nor are there any records suggestive of its doing so in any part of our area.

It moves about locally in winter, doubtless as food supply directs. Cheesman noted that a passing flock flying high were much terrified on meeting an aeroplane and scattered in all directions, quite a different behaviour to Storks under a similar circumstance.

Four specimens obtained : ♀, Sheik Saad, 13-3-17 (Ingoldby) ; ♀, Amara, 4-2-18, w. 334. B. 59 mm. ; ♀, 4-2-18, wing 319, B. 61 mm. ♀, Hamar Lake, 20-5-18., w. 340. B. 66 mm. (P. A. B.)

These birds certainly belong to the smaller European-Asiatic race and not to our familiar form of the British Islands.

193. Pygmy Cormorant. Phalacrocorax pygmæus. "El Echi."

Phalacrocorax pygmæus (Pall). (Reise Prov. Russ. Reichs, ii, p. 712. 1773—Caspian Sea).

Common and resident, breeding in some of the marshes and moving out locally to the rivers and other marshes in winter. Tomlinson received a number of eggs on May 15th, which had been taken by Arabs in the marshes near Ezra's Tomb. An Arab, who knew the marsh birds well, told Logan Home that the Cormorants at Abu Aran in 1919 had nested in April. Pitman saw Cormorants probably of this species in the marshes near Museyib on June 12th, and Cheesman saw many on the Horr Sanaf at the end of March, but no one seems to have actually come across a breeding colony, though probably many must exist in the Euphrates marshes and those to the east of Amara and Ezra's Tomb ; Buxton obtained adults on the Hamar Lake on May 20th.

Specimens examined : ♀, Horr Sanaf, 20-3-18 (P. Z. C. and R. E. C.), ♀, Hamar Lake, 20-5-18; (two) ♀, Ezra's Tomb, 23-12-18; (three) ♂, Horr Hawaize, 13-7-18 (P. A. B.).

These all belong to the European form *pygmæus* and not to the Indian *javanicus*. The younger birds, in the brown dress, of *javanicus* never seem to have the white filo-plumes on the flanks, rump, mantle and sides of neck which specimens of *pygmæus* in similar state of plumage have.

194. Shag. Phalacrocorax, sp. ?

Several observers noted Shags in winter ; Buxton says he saw them several times in November and December near Amara, Meinertzhagen saw one at Tekrit which he says was a very old *graculus ;* no specimens were obtained and so it is impossible to say what these birds were. Stoneham too saw many on islands below Baiji, and particularly noted some with crests.

The Common Shag (*graculus*) is entirely a west European bird and the Mediterranean Shag (*desmarestii*) is not certainly known east of the Grecian islands, while the Indian Shag (*fuscicollis*) is hardly known west of Sind so it would be of great interest to know what these birds in Mesopotamia really are.

195. African Darter. Anhinga rufus. "Warda."

Anhinga rufus rufus (Lacep.) (Tab. Ois. Daudin, Buffon's Hist. Nat. xiv, p. 319, 1802).

The Darter is common and resident in the huge marshes round Kurna and east of Amara and Ezra's Tomb. Elsewhere we have no records of it. No one seems to have found it nesting but Tomlinson had a number of eggs brought to him on

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May 15th from the Ezra Tomb district by the Arabs. Only one specimen was obtained, a male from Ezra's Tomb on February 23rd, by Buxton. I have compared the bird with a large series of African birds; these latter vary very much *inter se* according to age and perhaps individually, and I can match this Mesopotamian bird in every detail with many African skins. A race has been described from the sea of Antioch by Oustalet as *chantrei* (Ann. Sc. Nat., Paris, July 1882, art. 7). All the differentiating characters which Oustalet gives for his race are to be found in many African birds, as already pointed out by Tristram (Ibis., 1886, p. 41); whether *chantrei* is really separable from *rufus* I do not know, but as this Mesopotamian skin cannot be picked out from a series of African ones I must place the Mesopotamian birds as belonging to the typical race, at any rate for the time being.

Mr. Jourdain informs me that of Darter's eggs he received from Tomlinson (sub nomine *chantrei*) "some were white, unmarked and some had the peculiar violet brown blotches already noted in the eggs of this species by Ottosson in eggs from the Lake of Antioch."

196. Grey Lag Goose. Anser anser.

Anser anser (L.) (Syst. Nat. Ed., x, p. 123, 1758—Sweden).

Grey Geese are extraordinarily abundant in the great marshes and swamps of lower Mesopotamia. The main flocks arrive about the last week in October, and from then onwards flock after flock may be seen passing over or arriving daily at their winter quarters, though the first flocks may arrive a week or two earlier. Early in March flocks may be seen again wending their way north and most of the winter visitors have gone by the end of the month. Both of these geese are abundant in winter and many are caught by the Arabs and brought into the markets, such as at Amara, alive for sale.

The Grey Lag Goose besides being a winter visitor is certainly also a resident in small numbers, and very late and very early records probably belong to those birds which remain during the summer in the marshes. Thus Logan Home reports some still left, *mostly paired*, on May 5th, and there are quite a number of records of small numbers seen throughout July in such places as Suweikiyeh marsh, marshes near Ezra's Tomb, and at Gurmat Ali and Akkarkuf in early August. On May 21st when Buxton was at the Hamar Lake he obtained three goslings from the Arabs who had caught them in the reed beds there; two of these were eaten by mud turtles and the third Buxton preserved. Both Buxton and Cheesman say that they have never seen domestic geese in the country, nor any semi-tame Grey Lags in any of the villages; so that it seems perfectly certain that some Grey Lags stop and breed in the marshes. "Gaggles of Grey Lag used to fly in the early morning above no man's land on the way to the Suweikiyeh marsh and were invariably greeted by a ragged fire from the Turkish front line. On one occasion a bird was dropped behind our front line trenches and was safely retrieved, although a machine-gun was laid on to it. The O. C. snipers in my battalion brought down one with his rifle; and aeroplanes used to practise their Lewis guns on these birds. Many of the gaggles which frequented the marshes near Basra roosted during the day well out on the bare desert" (Magrath). Flocks of Geese passing overhead afford tempting shots with a rifle but very few were obtained in this way.

Three specimens examined:—Legait, 12-16 (Livesay); Samarra, 25-12-17 (C. R. P.); *pull* Hamar L. 21-5-18 (P. A. B.).

197. White-fronted Goose. Anser albifrons.

Anser albifrons (Scop.) (Annus I, Hist. Nat., p. 69, 1769—Carniola).

There is little to add about the White-fronted goose, it appears to come and go at the same time as the Grey Lag. There is no suggestion that it breeds in

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the country, nor is it likely to do so, as its known southern limit of breeding range lies much further north. It is very common in winter and large numbers are brought into Amara market alive.

Five specimens examined : Samarra, 22-12-17 (two) (C. R.P.), Mesopotamia and (Bagnel), Amara (two) (P. A. B.) .

198. Lesser White-fronted Goose. Anser erythropus.

Anser erythropus (L.) (Syst. Nat. Ed. x, p. 123, 1758—Sweden).

Apparently not at all common ; Buxton obtained one out of a small party on some wet irrigated plough land at Amara on November 28th and thought he saw others at different times. Thornhill recorded a flock of five at Wadi on March 20th ; Pitman saw a flock at Suweikiyeh marsh on December 3rd. Zarudny records it in winter and he also records *Anser arvensis* as a rare winter visitor ; we have no records of any Bean Goose and Buxton failed to meet with it among great numbers of geese in the Amara bazaar.

Pitman seems pretty sure that he saw the Red-breasted Goose on several occasions round Kut, Kurna and Qalet Saleh in winter ; Thornhill records that he heard of vague statements regarding geese which seemed suggestive of this species, so awaiting further evidence I do not definitely include it ; it is abundant on the south Caspian coast in winter and so might easily occur in Mesopotamia.

199. Mute Swan. Cygnus olor.

Cygnus olor (Gm.) (Syst. Nat. pt. 2, 1789, p. 501—Russia).

Swans are evidently rather rare winter visitors to Mesopotamia. Butler has recorded (S. F., 7, p. 105) that he learnt through the telegraph people at Fao that swans occasionally occur at the head of the Persian Gulf and mouth of the Euphrates.

In the winter of 1916 a herd frequented the Suweikiyeh marshes, as recorded by Thornhill and others ; but what species of swan it is that visits the country was unknown until Robinson secured an adult female at Kut on January 8th, 1918, and sent it to the Bombay Museum ; it turned out to be of the above species.

200. Common Shelduck. Tadorna tadorna.

Tadorna tadorna (L.) (Syst. Nat. Ed. x, p. 122, 1758—Sweden).

In lower Mesopotamia this species is a fairly common winter visitor to the shallower floods and is, as elsewhere, extremely wary ; round Baghdad however and perhaps elsewhere it must breed, as Pitman on July 22nd at L. Akkarkuf saw adults with young ones, and caught and reared four of the latter ; there are several other records which shew that some, at all events, are to be met with at a time when they might be supposed to be breeding ; thus Logan Home records seeing pairs in May, as also did Pitman at Nukta on May 28th, and Thornhill recorded seeing at pair at Hanna on July 11th ; one was seen at Azizieh on June 18th.

Four specimens examined : Amara (P. A. B.), Mesopotamia (Macdonald) Busra (Wernicke) Juv. L. Akkarkuf, 15-8-17 (C. R. P.).

201. Ruddy Shelduck. Tadorna casarca.

Tadorna casarca (L.) (Syst. Nat. Ed. 12, 3, App. Anim., p. 224, 1768—Astrachan).

On the Adhaim river and on the Tigris north of this to Tekrit and probably beyond, and also round Bund-i-kir in the Karun district, the Brahminy duck is resident and breeds ; to the rest of Mesopotamia it is a moderately common winter visitor. Pitman says that at Istabulat it breeds in ruins, cliffs, marl

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mounds and canal banks ; it was nesting in May and June, the holes going 14 feet in and 7 feet below the level of the ground. Thornhill, who found a nest of eight eggs in low hills near Samarra says the nest was situated 20 feet in and four feet down, they were nesting in April and May. Logan Home put several old birds out of nesting holes in the cliffs of the Samarra-Tekrit area and found a duckling in June. Harrison says of the Adhaim river that the birds were paired off in April and were breeding in May. In the above districts it is fairly common. Tomlinson has recorded it breeding on the Gagar river in April 1908 and found young out in June ; on re-visiting the locality in 1913 no trace could be found of any breeding there and he was told by the natives that none had bred since 1913 ; Cheesman however saw pairs which were evidently breeding in much the same locality, *i.e.*, near Bunder-i-kir on May 24th, 1917. Though it occurs on the Euphrates at Ramadi and Feluja in winter, there is no evidence as yet that it breeds there ; Pitman failed to meet with it at the latter place after May 7th.

One specimen : Amara, 13-1-18 (P. Z. C. and R. E. C.)

I will not swell the list of Mesopotamian birds by including the Egyptian Goose (*A. ægyptiaca*) which Weigold says he saw a pair of " at a great distance " at Urfa on April 11th ; one *may* be mistaken over birds seen at a great distance and further evidence is desirable before admitting this species to our fauna.

202 Mallard. Anas platyrhyncha.

Anas platyrhyncha, L. (=*boschas* auct). (Syst. Nat. Ed. x, p. 125, 1758—Sweden).

203. Gadwall. Anas strepera.

Anas strepera, L. (Syst. Nat. Ed. x., p. 125, 1758— Sweden).

204. Pintail. Anas acuta.

Anas acuta, L. (Syst. Nat. Ed. x, p. 126, 1578—Sweden).

205. Wigeon. Anas penelope.

Anas penelope, L. (Syst. Nat. Ed. x, p. 126, 1578—Sweden).

206. Shoveler. Spatula clypeata L

Spatula clypeata, L. (Syst. Nat. Ed. x, p. 124—S. Sweden).

Wild fowl are exceedingly abundant on the rivers, swamps and lakes of Mesopotamia ; the marshes round Kurna, Babylon and the Suweikiyeh marsh, to mention some of the best known, teem in winter with vast flocks of geese and all kinds of ducks, and both reed-girt and open pieces of water are indifferently used. But few arrive before mid-August or early September and the majority come later than this ; most leave in March though in places plenty may yet be seen in April and even into May. On the Adhaim river huge flocks were seen going south during September early in the morning, but this movement ceased by the end of the month.

The Mallard is somewhat unevenly distributed and, as in other places, this is probably due to suitability or otherwise of feeding ground, as it seems to be a more particular duck in this respect than some others ; thus while some found it to be the commonest duck, others reported that it was never very common, for instance in a bag of 100 duck at Nasariyeh only one Mallard figured, while at Ezra's Tomb, Buxton considered it to be the commonest species; of course even in Mesopotamia the Mallard is well able to take care of itself, and this may partly account for its apparent scarcity, as it prefers places where a good look out can be kept, such as the river or the middle of large pieces of water.

If it is doubtful if the Mallard breeds in Mesopotamia, at least there is no certain evidence. The late Captain Thornhill has recorded that he saw it in every month of the year and that it probably breeds ; I questioned him about it (and I know he was too good a *shikari* to have confused it with any other duck)

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and he was quite certain about it, though he could give me no positive proof of nesting. Buxton thinks that on Akkarkuf lake on October 12th he saw flappers which "almost certainly belonged to this species". Some certainly stay very late; a flock of 20 were seen by Logan Home on May 21st, and some appear very early, by July, (Magrath) and a good many by mid-August; so that it is within the bounds of possibility that some may nest, though futher evidence is desirable.

The Gadwall is another very common and widely distributed duck, but there is nothing particularly noteworthy to say about it. A few are recorded as early as August 1st and some stop late—May 6th, a pair at Feluja, May 15th and 21st small lots seen on Euphrates inundation. There is no evidence at all that it nests.

In places Gadwall make up a large proportion of the bag, 40 and 47 being reported in two bags made in January on the Euphrates inundation.

Three specimens examined: ♂, Sheik Saad, 24-1-17 (P. Z. C. and R. E. C.) ♂ Basra 1-19 (Hobkirk). Amara (P. A. B.).

The Pintail is common enough and appears to arrive and depart with the mass, there being no particularly early and late records; first seen September 13th and last noted April 13th; just at the time of departure huge flocks congregate together on the inundations.

The Wigeon is exceedingly abundant and is often seen in winter in great flocks on the marshes round Ezra's Tomb and Amara, etc.; they move off early in March, the last seen was on April 9th; they arrive late with the main mass, but early ones were noted in August near Baghdad.

The Shoveler is exceedingly common and perhaps the best distributed, as almost any kind of water suits it and thus it may be found in places other ducks would scorn, such as canals, small pools and puddles as well as being found in the marshes, lakes and inundations. It is plentiful by the first or second week in September and a few linger on into May, there being records on May 15th, 17th, 19th; there is however no suggestion that it breeds.

Being universally distributed and less wary than other ducks it figures largely in the bag in some spots; 20 or 30 are often got and in two bags of 100 birds, Shovelers formed 90 and 95 per cent., respectively.

An albino was reported by Logan Home.

Three specimens examined: ♀, Samarra, 4-1-18(C. R. P.), Amara (P. A. B.); ♀ Sheik Saad, 24-12-17 (Robinson).

207. Marbled Duck. Anas angustirostris.

Anas angustirostris Ménétr. (Cat. Rais. Caucase, p. 58, 1832—Lenkoran).

The Marbled Duck is a fairly common resident; it breeds in the vicinity of the Tigris and Euphrates in scrub along the banks to Baghdad and Feluja. It seems to prefer dry situations not far from the river or marshes; Pitman found a nest, in a *Sueda* bush close to crops, at Hindia Barrage some hundreds of yards from a canal, containing 10 eggs, and fresh eggs were brought in on May 28th and June 9th; in this locality it was plentiful. Thornhill found several nests below Kut and obtained two hard set clutches of five and six eggs on May 15th and 18th. Tomlinson records it breeding at Ali Gharbi, and Logan Home located a colony near Amara. At Shush and Shushtar it also must nest as breeding birds have been obtained by Cheesman and Tomlinson; and Watts found it breeding at the former place at the end of May.

Three specimens examined: ♂, Shush, 2-5-17 (P. Z. C. and R. E. C.); near Basra (Wood); ♂, Amara, 21-4-18 (P. A. B.).

208. Falcated Teal. Anas falcata.

Anas falcata, Georgi (Bemerk. Reise Russ., 1, p. 167, 1775—Asiatic Russia).

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Thornhill can hardly, I think, have made a mistake when he recorded that a male in full dress was shot on the river at Hanna on March 19th, 1916. Thornhill knew this and other Indian ducks exceedingly well and I personally interrogated him about it, and I do not think there can be any doubt that he was correct in his identification ; it can only be a rare straggler so far west ; it has occurred at least twice in Europe.

209. Common Teal. Querquedula crecca.

Querquedula crecca (L.) (Syst. Nat. Ed. x, p. 125, 1758—Sweden).

The Common Teal is an abundant winter visitor some arriving very early ; large flocks were reported near Baghdad on July 17th, on the Euphrates floods on July 31st and on Suweikiyeh marshes in mid-August. The majority however come in September. It is very widely distributed as it not only frequents marshes and lakes, but also the smallest irrigation canals in bare desert country, flooded fields, etc. Bags of 30 or 40 are often made and a bag of 64 is recorded. Most leave again in mid-March and the last were seen in the second week of April.

Cheesman records that on May 2nd he found Marbled and Common Teal both "evidently breeding" in a rush and willow covered Jheel at Shush ; this is the only evidence at all that this species nests within our limits and the fact requires further confirmation.

Four specimens examined : Amara. (two) (P. A. B.), ♀, Basra, 8-3-17 (Stevens) ; ♂, Samarra, 5-2-18 (C. R. P.).

210. Garganey. Querquedula querquedula.

Querquedula querquedula (L.) (Syst. Nat. Ed. x, p. 126, 1758—Sweden).

The Garganey, though scarce, is fairly well distributed in winter, but is much commoner as a bird of passage in August and September and again in April. Flocks were seen as early as July 17th near Baghdad and as late as May 21st. In the marshes near Hindia Barrage, Pitman clearly identified at close quarters; a flock on June 12th ; Logan Home records seeing them also in June, while Magrath says he caught a duckling on the Suweikiyeh marsh which he presumed to have been of this species, as he saw adults. It is possible therefore that a few remain to nest, though further definite evidence is required.

211. Tufted Duck. Nyroca fuligula.

Nyroca fuligula (L.). (Syst. Nat. Ed. x, p. 128, 1758—Sweden).

212. Common Pochard. Nyroca ferina.

Nyroca ferina (L.). (Syst. Nat. Ed. x, p. 126, 1758—Sweden), "Harra."

213. Red-crested Pochard. Netta rufina.

Netta rufina (Pall). (Reise. Russ. Reichs. App., p. 713, 1773—S. E. Russia).

In the absence of any outstanding early records as we have with the surface feeding ducks, it may be taken that these diving ducks arrive in Mesopotamia later and it is probable that not many are seen before October. These three are widely distributed and common on suitable sheets of water and are often seen resting in flocks on the rivers themselves. Round Amara, Buxton noted that the Tufted was rarer than the Common Pochard, but in other places it appears to be common enough. The bulk of these diving ducks leave in March, but Buxton found that the Common Pochard in the main stayed longer, and both Tufted and this species may be seen up to the second week of April. The Red-crested Pochard is fairly common but hardly as numerous as the other two ; stragglers linger on till the last week in April.

One specimen of each preserved.

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214. Scaup. Nyroca marila.

Nyroca marila (L.). (Fauna Suecica, Ed. 2, 1761, p. 39—Lappland).

Zarudny records it as a rare winter visitor to the Karun area. It is not likely that this species, which much prefers salt water in winter, will be found in the Mesopotamian marshes and lakes.

215 White-eyed Pochard. Nyroca nyroca.

Nyroca nyroca (Güld.) (Nov. Comm. Petrop., 14 pt. 1, p. 403, 1770—S. Russia.)

The White-eye must be a common duck in winter but there are hardly any records of it. Logan Home says many were seen and a few shot on the Euphrates inundations, and Zarudny gives it as a winter visitor.

216. Golden Eye. Glaucion clangula.

Glaucion clangula (L.). (Syst. Nat. Ed. x, p. 125, 1758—Sweden).

This is not a common duck ; occasional birds are to be seen frequenting the rivers, singly or quite a small party together ; Ludlow saw a flock and shot one at Hit ; Thornhill obtained a male at Hanna on March 20th and there are odd records from the Tigris, Euphrates and Shat-al-Arab.

217. Smew. Mergus albellus.

Mergus albellus (L.). (Syst. Nat. Ed. x, p. 129, 1758—Smyrna).

This species too is uncommon ; a few are recorded from the Tigris and Shat-al-Arab in winter, and like the Golden-eye it would seem to prefer the rivers to the lakes ; it occurs singly or in quite small parties. The acuity of vision of these and other species which obtain their living in the waters of the rivers must be very great, as the water is so loaded with silt that to the human eye it appears quite opaque.

Two specimens were obtained near Amara by Cheesman and Bagnall in February and December, and two by Buxton at Amara.

[The Goosander has been recorded as having been seen fairly commonly on the Tigris by Meinertzhagen (Ibis, 1914). No other records of this species are to hand and no specimens have been obtained. The Merganser (*M. serrator*) has been obtained at Bushire but not so far in Mesopotamia.]

218. Stiff-tail Duck. Erismatura leucocephala.

Erismatura leucocephala (Scop.) (Annus. 1, Hist. Nat., p. 65, 1769—N. Italy).

A rare duck in Mesopotamia ; one was obtained by Hobkirk at Gurmat Ali on April 21st ; another near Kut by Thornhill on February 6th and a third on a jheel (Abu Jisra), 70 miles north of Baghdad, on March 23rd, 1920, by Major Chrystall ; possibly one or two others were obtained.

219. Flamingo. Phoenicopterus ruber.

Phœnicopterus ruber antiquorum, Temm. (Man. d'Orn. 2, p. 587, 1820—Europe).

The Flamingo is a not uncommon resident and in some favoured localities it may be said to be abundant, such as in the marshes round Museyib. But almost anywhere where suitable inundations exist some may be seen in any month of the year, the flocks moving about locally according to the varying conditions of the marshes. Doubtless many move away to their nesting haunts in the breeding season, but a good many non-breeding and immature birds remain behind.

According to Cumming it breeds on the Koweit side of the head of the Gulf, whence I believe he obtained from the Arabs many eggs which are now in the Karachi Museum.

The Flamingo is generally distributed throughout our area.

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220. Common Heron. Ardea cinerea.

Ardea cinerea cinerea, L. (Syst. Nat. Ed. x. p. 143, 1758—Europe).

The majority of this species are no doubt winter visitors, but a number may be met with during the summer months in suitable places such as the marshes at Museyib, etc. As this heron does not breed in its first year doubtless many of these are non-breeding birds ; though no nests were reported yet it is quite possible some may breed in these extensive swamps, indeed Cumming had eggs brought to him at Fao said to have been taken on the Abdulla Banks ; they may have come from there or perhaps the marshes on the Koweit side ; Logan Home thought it might nest on the cliffs at Tekrit as he saw birds in the vicinity from April to June but no definite evidence was forthcoming. It is common in winter and widely distributed. Probably a certain number are passage migrants as Cheesman saw a flock pass over Shaiba, an oasis well out in the Arabian desert, on September 16th flying S. W. which direction would take them towards the centre of the Arabian continent.

One skin examined : L. Akkarkuf, 12-8-17 (C. R. P.).

221. Purple Heron. Ardea purpurea. "Er Kheawwi."

Ardea purpurea purpurea, L. (Syst. Nat. Ed. xii, p. 236, 1766—East Europe ?)

The Purple Heron is reported in all months of the year as common and it probably is quite resident. We have however no definite information of its nesting and yet one can hardly doubt its doing so with such extensive marshes at hand so eminently suited to its requirements. It is reported as common in the breeding season in the marshes of the Amara-Kurna district and at Museyib. Pitman remarks that this species is not so common as *cinerea*, but where it is found, it swarms ; there are naturally many places where the latter may be found which do not suit the Purple Heron, which likes lakes and swamps with plenty of cover in the way of reeds and rushes.

One bird was found which, in trying to swallow a three-quarter pound fish, had become *hors de combat* through partial suffocation ; however much smaller 'fry' does not come amiss as Buxton found a dragon fly of the genus *Anax* in the gullet of one he shot.

Cumming obtained eggs at Fao which were said, like all his eggs of the *Ardeidæ*, to have been taken near the Abdulla Banks, presumably from the marshes on the Koweit side.

Ten skins examined : ♂ ? , Kurna, June 1916 (F Wall) ; Qalet Saleh, 7-7-17 (Elmhurst) ; L. Akkarkuf, 26-7-17, 26-8-17, 21-8-17 (C. R. P.) ; five, Amara (P. A. B.)

222. Goliath Heron. Ardea goliath cretzschm.

Ardea goliath cretzschm (Ruppel's Atlas Reise n. Afr. Vög., p. 39, 1826).

In the extensive swamps of Mesopotamia this gigantic Heron is not uncommon and evidently resident. It is reported from the marshes that lie between Basra and Kurna, from those near Amara and Kut and round the Euphrates Barrage, while there are odd records from Feluja and Samarra. Sir Percy Cox obtained young ones from the marshes at Kurna and sent them alive to the Bombay Natural History Society. Buxton remarks that in the field this species much more resembles the Purple than the Common Heron.

This is one of those species which Africa may be said to have contributed to the Mesopotamian fauna; it is found throughout tropical Africa outside of which it is only known in Ceylon and parts of eastern India, where it is rare and sporadic, a very curious distribution.

223. Reef Heron. Demiegretta asha.

Demiegretta asha (Sykes). (P. Z. S., 1832, p. 157, W. Coast of India).

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The Reef Heron only occurs in our area on the Fao littoral. Armstrong found it fairly common at Fao and had eggs brought to him, said to have been taken on the Khor Abdulla, on May 20th, 1917. Cumming records it as also common there and obtained several birds and received eggs from the Koweit side. In the *Ibis*, 1886, Sharpe records two of these birds obtained by Cumming as *gularis*, the west African bird ; Mr. Kinnear has examined these birds afresh for me in the British Museum and he considers them to be nothing but *asha*. Both blue and white phases of plumage occur and Cumming considered the white to be the juvenile dress, an observation I cannot confirm.

It is a quite resident species and being essentially a salt water bird is not likely to occur inland.

224. Buff-backed Heron. Ardeola ibis.

Ardeola ibis ibis (L.) (Syst. Nat., 1758, p. 144—Egypt).

This Heron does not seem to be very common and its status is rather uncertain ; Cumming thought that it was resident at Fao and says it is supposed to breed near the Abdulla Banks, in the marshes on the Koweit side. All our records relate to the months of March to October so may be it is a summer visitor. Logan Home noted it at Abu Aran in June. Cheesman records that a flock alighted in a cottonfield at Sheik Saad on September 16th and thinks they were on passage ; two, which he obtained there, were the only specimens preserved.

225. Squacco Heron. Ardeola ralloides. " Mush-'bea Beda."

Ardeola rallöides (Scop). (Annus i, Hist. Nat., p. 88, 1769—Carniola).

The status of this bird requires further investigation ; all our records relate to the months March-September except two, *viz.*, January 6th (Shat-al-Arab) and October 23rd (Ramadi), so that, on the face of it, it would appear to be a summer visitor. From the end of March it is common in suitable places in small flocks of eight to twenty individuals, and some were thought at this period to be migrating, as at Feluja, Basra, etc. On May 19th, Buxton found it at the Hamar lake and shot a specimen with the sexual organs enlarged, but he was told by the Arabs that it does not breed there; on June 5th near Amara he saw plenty ; Pitman too, in the marshes around Museyib met with it commonly in June and July and supposed it was breeding, while near Baghdad it was common in July-August and September ; in many places in August and September it is noted as common. Cumming says it is resident at Fao and is supposed to breed in the marshes on the Koweit side of Fao. It seems therefore likely that the species will be found breeding in the marshes of Mesopotamia, though up to now there is no certain record.

Eight specimens examined : ♂, Hamar Lake, 20-5-18 ; Baghdad, 31-3-18 ; Amara, 14-4-18 (P. A. B.) ; ♂, Nahr Umar, 26-3-18 ; Feluja, 27-3-17 ; near Baghdad, 8-8-17 (C. R. P.) ; ♂, Basra, 19-4-17 (P. Z. C. and R. E. C.) ; Basra (Hobkirk).

I do not think this Heron can become adult at the first spring ; some of these are in adult plumage, others at the same time of year are in immature dress.

Ardeola grayi has been recorded from Bushire ; we have no evidence of it occurring within our area.

226. Little Egret. Egretta garzetta.

Egretta garzetta garzetta (L.) (Syst. Nat. Ed. xii, p. 237, 1766. " In Oriente ").

As with several of the Heron tribe, the status of this bird cannot be made out with certainty. Cumming thought it was resident and recorded that it was supposed to breed near the Abdulla Banks. All our records are of small numbers seen in the months of April, August and September which suggests that it is a

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passage migrant or possibly a summer visitor whose breeding quarters were not discovered by any observer, quite a possibility when the huge expanse of some of the marshes is remembered.

Pitman records small flocks on passage at Feluja on April 26th and 27th ; the earliest date on which this species was noticed was April 14th and there are several records from the lower Tigris during this month. It was noted again on August 5th and, on and off, till early in September near Baghdad and in other places. Pitman obtained one specimen on August 23rd ; there are two others in the British Museum.

227. Great White Heron. Egretta alba.

Not very common ; there are scattered records from widely separate districts from November to February so that probably it is a winter visitor in small numbers. Logan Home records a pair at Samarra on May 12th. Zarudny gives it as a passage migrant in the Karun area. No specimens were obtained but it probably is the typical race which occurs.

228. Night Heron. Nycticorax nycticorax.

Nycticorax nycticorax nycticorax (L). (Syst. Nat., x, p. 142, 1758—S. Europe).

The status of the Night Heron is not at all clear ; Cumming says it arrives at Fao in October and leaves in May and from other evidence it is quite clear that it is present in winter ; on the other hand there is good proof that in places it nests, so that perhaps at the most it is a local migrant. As elsewhere it seems to have its favourite haunts, so that where it occurs, hundreds may be seen together, whereas over large tracts of country it may not be met with at all. Thus near Qalet Saleh there is a very big roost where thousands come to spend the day in the date palms, and Buxton noted a fair sized roost at Amara in March, otherwise one may say it is generally distributed, though patchily.

Tomlinson records that it breeds at Shustar in June and Logan Home found a colony six miles below Amara where the birds on April 11th were just beginning to build, while at Samarra he saw five or six fully grown young by the river bank on June 12th ; it probably breeds near Museyib, according to Pitman.

Four skins examined : Lake Akkaruf, 18-8-17 (C. R. P.) ; Amara, 12-1-18 (P. Z. C. and R. E. C.) ; Amara, two (P. A. B.).

229. Little Bittern. Ixobrychus minutus. "Moodoo-wacha."

Ixobrychus minutus minutus (L.). (Syst. Nat. Ed. xii, p. 240, 1766—Switzerland).

Though Zarudny gives this species as a passage migrant and winter visitor, it appears from our records that the majority are summer visitors and some perhaps resident all the year. We have very few winter records and it is not until the end of March and early April that it becomes at all numerous. It breeds fairly commonly in lower Mesopotamia at all events, but appears to be commonest in the Basra district to Fao and Shush. Nest building commences in the first week of May or a little earlier and fresh eggs may be found from mid-May to early June. Tomlinson has found eggs as early as May 8th. According to Hobkirk and Logan Home the nests are situated in dense high reeds in the marshes and made of dead reeds and placed about two feet above the water ; an unusual site for a nest was found by the latter observer ; the nest was fifteen feet up in a mulberry tree growing by the water side, it was built of fine twigs and lined with green mulberry leaves, the male was standing on the empty nest on May 4th ; when visited again on the 17th the nest contained seven eggs, a number which was reported on two other occasions, though five or six is more usual ; the female, when incubating, sits very close.

Four specimens examined : ♂, Kamisiyeh, 4-1-17 (Aldworth) ; ♀, Shush, 3-5-17 (P. Z. C. and R. E. C.) ; ♂ ♀, Basra, 22-5-19 (L. Home).

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230. Common Bittern. Botaurus stellaris.

Botaurus stellaris stellaris (L.). (Syst. Nat. Ed. x, p. 144, 1758—Sweden).

A winter visitor in small numbers to those lakes and marshes which afford suitably thick cover. In the marshes south of Baghdad it is not very uncommon and found singly as a rule, and usually one or two are flushed when out duck and snipe shooting. The earliest record is September and the latest April 20th and a straggler in May.

Two specimens examined : ♀, Basra, 8-3-17 (Stevens) ; Amara (P. A. B.).

231. White Stork. Ciconia ciconia. "Haji Lug-a-Lug."

Ciconia ciconia ciconia (L.) (Syst. Nat. Ed. x, p. 142, 1758—Sweden).

Common ; partly resident, also a passage migrant ; many no doubt are summer visitors and some spend the winter. To what extent the breeding birds are resident or summer visitors cannot be determined,as Storks may be seen in every month of the year and large numbers pass over Mesopotamia at the times of migration; to the lower parts of the plains it is a winter visitor and passage migrant.

The breeding range of the Stork in Mesopotamia is somewhat curious ; a line drawn from about Babylon on the Euphrates to Baghdad and then across to Mendali in the foot-hills makes the southern limit of the range except that a few nest at Shustar and Shush in Khuzistan (but not Ahwaz) ; to the north of this line every town on both rivers has its colony, and nests on houses,mosques and tall poplars are familiar to all who have been there, even Jonah's tomb at Nineveh is occupied. They start to repair their nests early in the year ; on February 19th at Samarra, and on the 21st at Beled, operations had begun. Nesting is in full swing by April and feathered young were noted in June. After the breeding season they collect in the neighbourhood in vast flocks preparatory to migrating or scattering further afield in the country, and so, from the end of July onwards, Storks may be seen in those parts where they do not breed. From mid-September till the end of October they are common and well distributed throughout the country and during this period large flocks may be seen passing, circling round and round at a great height, drifting south before the wind, doubtless migrants from further north. In winter it is scarce, but some may be met with in favoured spots all the winter in many different places. Spring migration starts early and begins fairly regularly in the middle of February and lasts through March and up to the first week in April during which time they become common again and frequent flocks may be seen going over north or north-west.

The migrations of the Storks are well known to the Arabs who suppose that they go on an annual pilgrimage to Mecca and are accordingly venerated by them for this, and because they select mosques for building their nests on, hence their title of " Haji." So much are they respected that when the question arose as to whether the golden tiles on the mosque at Samarra should be repaired the idea was abandoned as it entailed disturbing the Stork's nest, until someone suggested that as " Haji Lug-a-lug " was away at Mecca the nest was, for the time being, not required and so the repairs might be undertaken !!

Unlike some other species of birds, the flocks of these birds were not at all disturbed by aeroplanes flying close to them. The curious breeding distribution seems inexplicable, it cannot be on account of climate, or lack of suitable towns, as these exist at Sera, Baghela, Kut, etc., and Sera is no great distance from Kerbela where it nests and both are about equidistant from Baghdad. It has been suggested that they have remained from time immemorial on the sites of ancient cities which formed their breeding quarters when lower Mesopotamia was under the sea, but were this so Nasariyeh, Ahwaz, etc., should have their nesting colonies. It has been reported as breeding at Fao (Cumming) and at Old Basra (Stoneham) on hear-say evidence ; our latest information is that it does not breed at Fao now.

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232. Black Stork. Ciconia nigra.

Ciconia nigra (L.). (Syst. Nat. Ed. x, p. 142.—N. Europe).

Apparently a rather rare winter visitor; Cumming obtained one at Fao on September 5th, Magrath saw it near Amara on May 20th and there are a few records in winter.

233. Spoonbill. Platalea leucorodia.

Platalea leucorodia major, Tem. and Schl. (Faun. Jap. Av. p. 119, 1849—Japan).

The Spoonbill is either resident, or perhaps a summer visitor to Mesopotamia as we have no records between November 1st and the end of March. It is common in the marshes of the Euphrates and Tigris moving about locally as its food supply directs. A good many flocks are recorded in these marshes during the breeding season and it may possibly breed there; it certainly breeds somewhere as Cumming had a number of eggs brought him at Fao *said* to have come from Khor Moosa and the Abdulla Banks whence Armstrong also obtained eggs on May 20th.

No specimens were obtained, but those Cumming got at Fao were examined by Mr. Ogilvie Grant and were referred to this larger eastern race.

234. Glossy Ibis. Plegadis falcinellus. "Slinder."

Plegadis falcinellus falcinellus (L.) (Syst. Nat. Ed. xii, p. 24, 1766—Austria).

The status of this species is obscure and records are not very numerous: perhaps it is resident. Near Amara Buxton noted it in February, April, May and August and says it probably breeds. It is recorded in fair numbers at Kurna in January. It is noted as common near Baghdad from July to September and Magrath found it common in the Suweikiyeh marsh in August where it was "evidently breeding."

Buxton obtained one skin.

235. Red-cheeked Ibis. Comatibis emerita.

Comatibis emerita (L.) (Syst. Nat. Ed. x, p. 118, 1758—Switzerland).

It would seem that this Ibis is but a straggler to our part of Mesopotamia; Logan Home saw a few near Tekrit in February and thought it might breed in theFatah Gorge cliffs or in the higher rocky hills of the Jebel Hamrin, but there is no evidence that it does so. Cheesman who went all over the Fatah Gorge in the breeding season and was at Tekrit in every month of the year failed to find it; however one was shot at Tekrit by Aldworth. There is of course a very well known colony at Beredjik consisting, so Weigold estimated in 1912, of a thousand, whence they wander out to other places, such as Bambudj, fifty miles south.

One was brought home alive to the Zoo from Beredjik by Capt. E. H. Buxton. The bird is considered sacred by the Arabs.

336. White Ibis. Threskiornis æthiopicus.

Threskiornis æthiopicus (Lath.) (Ind. Orn. ii., p. 706, 1790—Africa).

White Ibises certainly occur and not very uncommonly in the district from Amara to Fao; but there are no records from Baghdad and northwards. All records relate to the winter months and to small flocks seen, except that Logan Home records them paired off in Amara marshes but gives no date. Cumming says they are plentiful and Fao in winter and obtained one there on October 25th (recorded as *melanocephala*, Ibis. 1891, p. 113). Hartert (Vog. Pal. Faun., p. 1226) states that the Sacred Ibis (*Th. aethiopicus*) occurs at Fao and Zarudny mentions it (J. F. O., 1911, p. 231) as a very rare vagrant to the South Caspian region. Mr. Kinnear therefore has been kind enough to hunt up Cumming's bird

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in the British Museum and he tells me that it has been incorrectly identified as the Indian bird, *melanocephala*, and is undoubtedly an example of the African bird—the Sacred Ibis—*Th. æthiopica*.

237. Common Crane Megalornis grus.

Megalornis grus (L.) (Syst. Nat. Ed. x, p. 141, 1758—Sweden).

The Common Crane is a not uncommon winter visitor and probably a fair number pass through on passage for quarters further south. It seems to be generally distributed in the marshes. No specimens were obtained.

238. Demoiselle Crane. Anthropoides virgo.

Anthropoides virgo (L.) (Syst. Nat. Ed. x, p. 141, 1758—N. Africa).

There are few records of this Crane ; probably the status is much like that of the Common Crane but fewer in numbers.

239. Great Bustard. Otis tarda.

The Great Bustard is almost confined to the rolling plains in the north of our area ; Meinertzhagen records that it was not uncommon round Mosul in January 1914, where he saw droves of seven and fifteen birds. Thornhill saw seven near Wadi early in March 1916.

There are somewhat vague and uncertain records of the bird from Kut and Feluja, but Watts saw a flocks of six, a day's march from Amara ; Weigold saw two near Urfa in April and Egerton obtained one at Kizil Robat.

Exact status unknown. No specimens examined.

240. Little Bustard. Otis tetrax.

The status of this bird is quite unknown, Tristram met with it at Urfa in 1881 and it occurs over the Syrian boundary in that region. It was vaguely reported in several places in lower Mesopotamia, but the only record which seems certain is of a bird seen near Shush by Watts, and reported to me by Ludlow, who described the characteristic " butterfly" flight. Cumming relates that he once shot a smaller Bustard than the Houbara at Bushire and obtained another like it on board ship at Fao ; probably they were of this species although they were never satisfactorily identified.

Zarudny says this Bustard occurs in the Karun district where also the Florican (*Sypheotis auritus*) is an accidental wanderer.

241. Houbara. Chlamydotis undulata.

Chlamydotis undulata macqueeni (Gray). (Ill. Ind. Zool., ii, 1834—India).

The Houbara is pretty common in suitable places throughout Mesopotamia and is resident, or at the most a local migrant. It is, of course, a bird of grassy plains and desert country in which there is a certain amount of scrub. In the Samarra-Tekrit district it is common, occurring in parties of three to ten, sometimes singly, and it is reported as fairly common from Hit downwards on the Euphrates and as far as Kut on the Tigris; below this it is rather less numerous, no doubt due to suitable ground being less extensive. In the foothills it is common again at Mendali, Shush, Bund-i-Kir and doubtless elsewhere and it inhabits suitable parts of the Arabian desert on the west side of the river. According to Mr. Philby it is common in the Hinterland of Arabia and breeds freely there.

Logan Home and Aldworth found two nests on May 5th in the Samarra district and another on May 19th on the grassy plains near the river ; the nests contained one, two and three eggs respectively, those taken on the 19th being very far incubated. Pitman reports it breeding in May and June on the plain between Baghdad and Museyib, and it evidently nests round Kut, Rumailah and doubtless in many other localities. There are eggs in the British Museum from Koweit

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(Cumming), Zobeir (Marshall) and Diz, April 25th (Douglas). In the Bombay Museum there is an egg taken in March by Capt. Wilson in lat. 33° (south of Baghdad).

One skin examined : ♂, 25-10-18, Samarra (P. Z. C. and R. E. C.).

242. Stone Curlew. Burhinus œdicnemus.

1. *Burhinus œdicnemus saharæ.* (Rchw.) (J. f. O., 1894, p. 102—Tunis).
2. *Burhinus œdicnemus astutus.* Hart. (Nov. Zool., 1916, p. 93—Fao).

The Stone Curlew is fairly common in suitable places and both the above races occur. Unfortunately the collections do not contain any breeding birds and so the status of the two races cannot be made out, but Stone Curlew are to be found throughout the year and breed in the country. Logan Home noted it as common on the shingle islands along the river at Samarra on June 15th, the birds were paired and were courting; it is also found all up the river to Tekrit, he also saw it at Shaiba in May and June. Pitman noted quite large flocks of twenty to a hundred individuals in the Adhaim area from September to November, they spent the day in the scrub and flighted out to the plains at night, at which time they were very noisy; specimens which he obtained at that time I refer to *saharæ*. On August 1st Buxton found Stone Curlews common in the stony desert at Khanikin whence they flighted to the valleys at sundown, one he obtained there is certainly *astutus* and the date is early enough to suggest that it was a breeding bird of the district; on the other hand Pitman obtained a specimen of *saharae* at Lake Akkarkuf on August 21st. It would be very remarkable if both these forms breed in the same area, possibly one is a hill form and comes to the plains early in autumn and the other is resident in the plains. Further investigation is required on this point and some breeding birds from different areas are essential.

Pitman obtained incubated eggs in the flat open country near R. Hai near Kut on June 15th and two stale incubated eggs on May 20th near the Es Sinn position. Stoneham says that this bird is quite good eating.

(1) L. Akkarkuf, 21-8-17; Adhaim, 27-9-17, 9-10-17 (two) (C. R. P.); ♀, Shustar, 2-1-18 (F. M. B.); Frontier of Arabistan, 1916 (W.); wing, 232-250, bill (base) 41·5-43 mm.

(2) ♀, Khanikin, 1-8-18; wing 243 (P. A. B.); ♂, Sheik Saad, 3-10-16; wing 246, bill (base) 43·5 mm. (P. Z. C. and R. E. C.); also a specimen from Fao in the British Museum.

243. Cream-coloured Courser. Cursorius gallicus.

Cursorius gallicus gallicus (Gm.) (Syst. Nat. i, pt. 2, p. 692, 1789—France).

Without being called a rare bird the Courser, except perhaps in a few places, cannot be said to be common, and is rather local; though no nests were found it undoubtedly breeds and is resident.

Though found in the bare flat mud desert it would seem to prefer the sandier and more pebbly parts, such as the edge of the Arabian desert on the west of the Euphrates and in the Adhaim area, and the former district at any rate no doubt forms its chief breeding grounds, where Logan Home saw plenty in the breeding season and a family party of old and young were met with on May 25th at Shaiba; at Chunabdah in the same area and near Hindia barrage it was also reported in the breeding season, while Magrath notes it at Kut in July. A good deal of local migration probably takes place in the autumn. Buxton says that some he met with in clay desert, when the sun was low and casting a heavy shadow, were most conspicuous.

The young of the year moult their body-plumage and tails in the autumn, as with other Limicoline birds.

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Five specimens examined: Amara, 17-12-17 ; ♂, juv. Basra, 19-8-17 (P. A. B.) ; Amara, 2-12-17, juv. Shaiba, 12-8-18. (P. Z. C. and R. E. C.) ; Basra, 8-9-19 (L. Home).

These appear to me to be quite typical, wings 160-166 mm.

244. Common Pratincole. Glareola pratincola.

Glareola pratincola pratincola (L.). (Syst. Nat. Ed. xii, p. 345, 1766—Austria).

The Pratincole is a summer visitor and locally abundant. It arrives in the last days of March and by the end of the first week in April it is numerous in the areas in which it intends to breed.

There are many colonies dotted about in our area of which a few may be mentioned ; it breeds at Feluja ; on the drying edges of Lake Akkarkuf ; near Museyib ; at Chaldari, near Baghdad ; Samarra ; Suweikiyeh marsh ; Abu Aran ; near Fao ; and Ahwaz. The drying edges of marshes and inundations are favourite sites for colonies, the eggs being deposited in some depression such as a hoof mark in the dry hard mud ; at Samarra they were nesting on shingle on the edge of the river and at Ahwaz on sandy islands in the Karun below the rapids. At Chaldari and Sera, Cheesman found colonies on hard bare sun-baked desert some miles from the river.

Fresh eggs may be obtained at the end of April. Few birds are more demonstrative when they have young about than this species ; Cheesman says that on invading a colony, there were birds on the ground in all directions with drooping flapping wings, feigning disablement ; while Pitman, who witnessed the same performance, notes that in some lights the effect was very curious and that the display to draw off attention gave the appearance of a snake coiling about or a big lizard moving along ! !

Buxton noted that birds flying over a recently dried marsh at Amara were nearly out of gunshot but two birds then obtained had their mouths full of small "water-boatmen" (*Corixidæ* and *Notonectidæ*) which must have been flying at that altitude in bright sunshine. Others, which Cheesman examined, contained *Coleoptera* and Locust remains. Stoneham says they may be seen feeding on *Termites* after rain.

The Pratincole probably departs in August, the latest record is September 3rd.

Nine skins examined : ♂, Amara, 15-5-18 ; ♂, ♀, 7-4-18 (P. A. B.) ; ♂ ♀, Ahwaz, 30-4-17 ; ♂ ♀, Sera, 2-5-19 ; ♀, Baghdad, 12-5-19 (P. Z. C. and R. E. C.) ; Feluja, 15-4-17, (two) (C. R. P.).

These appear to me to be quite typical.

245. Black-winged Pratincole. Glareola nordmanni.

Glareola nordmanni, Fischer. (Bull. Soc. Imp. Nat. Moscow, xv, 1842, p. 314—S. Russia).

There is little to record about this species. Pitman shot two at Feluja on April 15th and saw them there and between there and Baghdad in May, where they were evidently breeding, as also at Hindia barrage. At the end of July and beginning of August he met with some on L. Akkarkuf. They were nowhere plentiful and were apparently breeding in the same colonies as the common species. The two birds obtained had their crops crammed with half grown locusts.

246. Red-necked Phalarope. Phalaropus lobatus.

Phalaropus lobatus (L.). (Syst. Nat. Ed., x, p. 148, 1758—Hudson Bay) (=*hyperboreus*, auct.).

Zarudny gives this Phalarope as a passage migrant and winter visitor. It may occur, though I never saw it, in the sea off Fao in winter, and might be found on passage in the marshes of our area.

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247 Woodcock. Scolopax rusticola.

Scolopax rusticola (L.). (Syst. Nat. Ed., x, p. 146, 1758—Sweden).

The country being unsuited to this bird's requirements, it is only a rare or perhaps occasional winter visitor. In different years there are six records of it at Basra from November to February; Aldworth obtained one at Tekrit in high crops on November 11th, 1918; and Thornhill records one at Kut on October 6th, 1916. In January and February 1918 they were said to have been "rather plentiful" in suitable places on the Diala river in the foothills district. It was met with also at Ahwaz.

248. Common Snipe. Gallinago gallinago. "Jehalul" or "Naja el Maya."

Gallinago gallinago gallinago (L.). (Syst. Nat. Ed. x, p. 147, 1758—Sweden).

Common winter visitor, abundant in suitable marshes. The first may be seen as early as August 3rd, quite a few by the middle of the month, but the bulk do not arrive till later. Plenty are still present in mid-April, most have gone by early May and stragglers are noted at the end of that month. There is no evidence that any remain to breed, Pitman found it absent from the marshes in the Museyib district in June and July. The Arabic name "Nāja-el-Māya" means "water-goat", evidently in reference to the drumming sound which, though constantly heard in the breeding season, may also sometimes be heard in the winter.

In favourable localities a couple of guns may easily obtain 40 to 50 couple in a day.

Three skins examined: ♀, Amara, 7-4-18 (P. A. B.); Samarra, 6-3-18 (C. R. P). ♀, Sheik Saad, 26-1-18 (Robinson).

Zarudny gives *raddei* also as a winter visitor; I am unable to recognize this race.

249. Great Snipe. Gallinago media.

Gallinago media (Lath.). (Gen. Synop. Supp., i, 1787, p. 292—England).

Our records tend to show that this species is a passage migrant, though Zarudny records it in winter also. Thornhill records it at Haibi in April where a small patch of wheat and flooded grass seemed full of them. Cumming met with it at Fao in April and Buxton got one at Amara on April 14th; it is also recorded from Shush in spring; Logan Home met with single birds near Basra on August 3rd and 29th, and Connor obtained one there on September 16th.

250. Jack Snipe. Limnocryptes gallinula.

Limnocryptes gallinula (L). (Syst. Nat. Ed., xii, p. 244, 1766—France).

Generally distributed in winter in suitable localities throughout our area and common; time of arrival was not noted, it was still common at the end of the first week in April.

251. Broad-billed Sandpiper. Limicola falcinellus.

Limicola falcinellus (Pont.) (Danske Atlas, 1, 1763, p. 623—Denmark).

Cumming obtained several at Fao in August and September where it must be common. We have no further records.

252. Terek Sandpiper. Terekia cinerea.

Terekia cinerea (Guld.) (Nov. Comm. Petrop., xix, 1775, p. 473—Terek River, S. E. Russia).

Probably common at Fao on the tidal mud flats where Cumming obtained several at the end of August and early in September. Essentially a maritime wader in winter.

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253. Little Stint. Erolia minuta.

Erolia minuta minuta (Leisl.) (Nach. zu Bechst. Naturg. Deutsch., 1812 p. 74—Hanau, Germany).

Buxton found this species abundant on spring and autumn passage in the marshes Magrath and Meinertzhagen noted small parties along the rivers in winter.

Exact status not fully known, probably a winter visitor and a passage migrant, as Zarudny states.

Four specimens examined : ♂ ♀, Akkarkuf, 6-10-17 ; ♂, Amara, 7-4-18 ; ♂, Baghdad, 21-9-17 (P. A. B.).

254. Temminck's Stint. Erolia temmincki.

Erolia temmincki (Leisl.) (*t. c. supra*, p. 78).

Winter visitor, fairly common in the inundations and along the rivers in suitable places. Some are probably passage migrants also.

Five specimens examined : Samarra, 8-2-18. ; Akkarkuf, 16-8-17 (C. R. P.); ♀, Amara, 24-3-18 ; ♂, 5-10-17 ; one, 30-12-17 (P. A. B.)

255. Dunlin. Erolia alpina.

Erolia alpina alpina (L.) (Syst. Nat. 1758, p. 149—Lappland).

Common winter visitor, arrives early in August and remains till the middle of May. Apparently some remain all the summer as non-breeding birds, as Logan Home saw " many " at Ratawi on June 19th.

Dunlins frequent edges of inundations, flooded fields, river banks, associating with Stints.

Three specimens examined : Amara, 25-1-18 ; Sheik Saad, 18-12-16 (P. Z. C. and R. E. C.) ; Samarra, 24-12-17 (C. R. P.) ; four, Amara, Jan.-April (P. A. B.).

These belong to the typical race, with bills 32-27 mm., wings 116-119 mm., which in my opinion extends east to western Siberia. I have already pointed out (Bull. B. O. C., xxxiii, p. 99) that there is not sufficient difference between birds from Lappland and West Siberia to warrant the distinguishing of a separate race from the latter locality, so far as present material is available. Hartert (Vog. Pal. Faun., p. 1576) recognises this race from Siberia doubtfully and lists it as ? *Erolia alpina pusilla*. Falk. 1786. If *Tringa* is used for the Stints, as is done in the B. O. U. list, then *pusilla* cannot be used for this race even if it were recognisable as it is not the *Tringa pusilla* of Linnæus, 1776.

256. Curlew Sandpiper. Erolia ferruginea.

Erolia ferruginea (Brün.) (Orn. Bor., 1764, p. 53—Iceland) (=*subarquata* auct.)

Meinertzhagen and Zarudny both record the Curlew Sandpiper in winter ; Buxton obtained examples at Amara in December and April ; probably it is a winter visitor and passage migrant.

[The Knot is recorded from the backwaters of the Tigris near Baiji, but as no skins were obtained and there are no other records for Mesopotamia I omit it. It would be interesting to confirm that this species winters on fresh water and so far inland, as I certainly do not think it is usual.]

257. Sanderling. Calidris arenaria.

Calidris arenaria (L.) (Syst. Nat. Ed., xii, p. 251, 1766—England).

Zarudny lists the Sanderling as a winter visitor, presumably to the head of the Gulf littoral. Probably common there.

258. Ruff. Machetes pugnax.

Machetes pugnax (L.) (Syst. Nat. Ed., x, p. 148, 1758—Sweden).

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Status doubtful and there are few records. Pitman found a few on L. Akkarkuf early in September, Livesay saw many on the Euphrates marshes on May 15th. Zarudny says it is a winter visitor to the Karun district, and Neumann records it from Ras-el-ain on February 14th. Stoneham notes it at Ctesiphon on March 22nd and Ludlow at Ahwaz on the 29th. Probably a not uncommon winter visitor and passage migrant.

One skin examined : L. Akkarkuf, 2-9-17 (C. R. P.).

259. Redshank. Totanus totanus.

Totanus totanus totanus (L.) (Syst. Nat. Ed., x, p. 145, 1758—Sweden).

Common winter visitor and generally distributed. It arrives at the end of July, but most come back in the middle of August and it is recorded up to the end of May, though most have gone a week or two earlier. Magrath records that he heard it near Amara on June 29th, so perhaps some non-breeders spend the summer.

Four skins examined : Samarra, 22-1-18 ; 25-12-17 (C. R. P.) ; ♀, Basra, 3-1-19 (Armstrong) ; ♀ Amara, 30-12-17 (P. A. B.).

Not distinguishable from W. European examples.

260. Spotted Redshank. Totanus maculatus.

Totanus maculatus (Tunst.) (Orn. Brit., 1771—England).

Zarudny records this as a winter visitor to the Karun district and Stoneham noted it at Samarra on May 17th. It is recorded from Biredjik by Weigold on May 1st and Ludlow shot two near Ahwaz in March. Probably it is commoner than the above records indicate.

261. Marsh Sandpiper. Totanus stagnatilis.

Totanus stagnatilis Bechst (Orn. Taschenb., ii., 1803, p. 292—Germany).

Probably a not uncommon winter visitor ; recorded by Zarudny, and Buxton obtained one at Baghdad on March 13th.

262. Greenshank. Totanus nebularius.

Totanus nebularius (Gunn.) (Leem. Beskr. Finm Lapp. 1767, p. 251—Norway).

Fairly common winter visitor; some arrive at the end of July; most of them in August ; leaves at the end of April.

Two skins examined : ♀, Azizieh, 16-10-08 (P. Z. C. and R. E. C.) ; ♀, Baghdad, 26-9-17 (P. A. B.).

263. Common Sandpiper. Tringa hypoleucos.

Tringa hypoleucos (L.) (Syst. Nat., 1758, p. 149—Sweden).

A winter visitor generally distributed on the rivers and canals but commoner as a passage migrant. It apparently arrives as early as mid-July and it is recorded as leaving about the middle of May. Tomlinson says it is resident at Basra and "immature birds were seen in the summer" but this does not necessarily prove that it breeds in Mesopotamia. Pitman too thought he saw it in the Hindia barrage marshes in June and July. Quite possibly some may spend the summer in their usual winter quarters if they are not going to breed that year.

Four skins examined : ♀, Amara 14-9-18 ; ♀, 14-4-18 (P. A. B.) ; ♂, Ahwaz, 24-5-17 (P. Z. C. and R. E. C.) ; Feluja, 9-4-17 (C. R. P.)

264. Green Sandpiper. Tringa ochropus.

Tringa ochropus, L. (Syst. Nat. Ed. x, p. 149, 1758—Sweden).

265. Wood Sandpiper. Tringa glareola.

Tringa glareola, L. (Syst. Nat., Ed. x, p. 149, 1758—Sweden).

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Both Wood and Green Sandpipers are fairly common. They arrive during August and both are recorded up to the middle of May by which time most have gone. Whereas the Green Sandpiper is certainly present all the winter, there are only two records of the Wood Sandpiper after October, odd birds being recorded by Pitman in February and December, so that in the main the latter species is a passage migrant and probably the former to some extent also.

266. Black-tailed Godwit. Limosa limosa.

Limosa limosa (L.) (Syst. Nat. Ed. x, p. 147, 1758—Sweden).

A common winter visitor frequenting the muddy margins of floods, etc. It arrives early in August and probably departs again in April and May. A certain number however spend the summer in the Euphrates marshes, as round Museyib and Ratawi; these of course are non-breeding birds as is the case with many other waders.

Six specimens examined: L. Akkarkuf, 12-8-17; 17-8-17 (C. R. P.); ♀, Baghailah, 11-3-17 (Ingoldby); ♂ ♀, L. Akkarkuf, 10-17; ♂, Amara, 17-2-18 (P. A. B.).

267. Bar-tailed Godwit. Limosa lapponica.

Limosa lapponica (L.) (Syst. Nat. Ed. x, p. 147, 1758—Lappland).

Recorded by Pitman from the mud banks of the Shat-al-Arab in January. It is probably common there.

268 Common Curlew. Numenius arquata.

Numenius arquata (L.) (Syst. Nat. Ed. x, p. 145, 1758—Sweden).

Common as a winter visitor and also as a passage migrant. Cumming says it arrives at Fao in July and leaves in March. Pitman records it as first seen in the Hindia marshes on July 10th, and huge flocks were passing over to the south-east during the first week in August near Baghdad. On the return passage he noted large flocks frequently from mid-April to May 25th at Feluja going north-east in the evenings.

It is equally at home on the floods and marshes as on the foreshore at Fao.

One skin: ♀, Amara, 8-1-18 (P. Z. C. and R. E. C.).

269. Whimbrel. Numenius phæopus.

Numenius phæopus (L.) (Syst. Nat. Ed. x, p. 146, 1758—Sweden).

Common passage migrant, arrives in July and August and the passage lasts till the end of September. Passes through again in April and May. Some may overwinter as Cumming records it as a winter visitor to Fao, and odd ones may pass the summer since Magrath records it from near Amara on June 30th.

270. Slender-billed Curlew. Numenius tenuirostris.

Numenius tenuirostris, Vieill. (N. Dict. d'Hist. Nat. viii, 1817, p. 302—Egypt).

Status quite unknown. Buxton saw many on December 16th, 1917, in a temporary winter lake in a hollow in the bare desert ten miles north of Amara and secured a specimen. This is the only definite record.

271. Black-winged Stilt. Himantopus himantopus.

Himantopus himantopus (L.) (Syst. Nat. Ed. x, p. 151, 1758—Egypt).

Resident and common in the larger marshes, spreading out in winter to temporary floods, etc. Magrath records that it breeds in the marshes above Amara but was much disturbed by shell fire in 1916.

Numbers breed on the Suweikiyeh marsh, some breed near Basra, and Pitman found it breeding plentifully in the Hindia and Museyib marshes. The first nest he found was on May 31st containing three incubated eggs; the nest was

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just a hollow in spongy ground; he found many more nests between June 2nd and 12th and all these nests were on mud mounds well above the general level and well out on the marsh; the birds had apparently constructed these mounds themselves; three or four eggs were the usual full clutch and the eggs varied very much in colour and markings. See plate.

Five specimens examined: L. Akkarkuf, 18-7-17 (C. R. P.); Amara, 24-1-18 (P. Z. C. and R. E. C.); ♂, Amara, 16-6-18; ♀, 24-3-18; ♂, Shahroban, 30-7-18 (P. A. B.).

272. Avocet. Recurvirostris avocetta.

Recurvirostris avocetta (L.) (Syst. Nat. Ed. x, p. 151, 1758—Sweden).

The Avocet is not very common but is resident and breeds. Quite small parties or single birds may be met with in the non-breeding season almost anywhere on the rivers and marshes. The only district that there are any records of its breeding in is Museyib where, on the west side of the Euphrates, Pitman found it nesting and on June 3rd took a nest of four eggs; the nest was just a depression in the ground on the edge of a marsh with a little grass material as lining; he also saw a few on L. Akkarkuf in July which he thought had bred there.

There are eggs in the British Museum labelled "Mesopotamia."

Four skins examined: ♂, Amara, 1-1-18 (two) (P. A. B.); ♂, Amara, 8-1-18 (P.Z.C. and R. E. C.).

273. Golden Plover. Pluvialis apricarius (=pluvialis, auct.).

Pluvialis apricarius (=*pluvialis*, auct.) (L.) (Syst. Nat. Ed. x, p. 150, 1758—Sweden).

274. Asiatic Golden Plover. Pluvialis dominicus.

Pluvialis dominicus fulvus (Gm.) (Syst. Nat. i, pt. 2, 1789, p. 687—Tahiti).

The Golden Plover is recorded as a winter visitor and the Asiatic bird as a passage migrant by Zarudny in the Karun district.

We have no records of the former, but Capt. Hanna obtained three of the latter near Sheik Saad on January 21st, 1921, as he informs me.

275. Grey Plover. Squatarola squatarola.

Squatarola squatarola (L.) (Syst. Nat. Ed. x, p. 149, 1758—Sweden).

Cumming obtained this species at Fao in September and October where it is probably a common winter visitor.

276. Common Ringed Plover. Charadrius hiaticula.

Charadrius hiaticula tundræ (Lowe). (Bull B. O. C., 36, p. 7, 1915—Yenisei).

Some records of the Little Ringed Plover may refer to this species as most observers were not aware that both occur, or simply entered their records as "Ringed Plover." The status of this bird is therefore doubtful, but it must be either a winter visitor or a passage migrant; Zarudny lists it as both. Buxton obtained two young examples on L. Akkarkuf on September 26th and October 6th where it is not uncommon. These have black bills and dull ochre-coloured legs and feet; a male measures in wing 123 mm. and an unsexed bird 127mm. From their small size and the darkness of the mantle I refer them to the Siberian race described by Lowe, though I am not quite certain that his name can stand. Mr. Schiöler (*Dansk Orn. F. Tids.*, 1915, p. 177-9), has gone very fully into the question of this race and its name, and considers that Mènètriès name *intermedius* should be used, but as this name is not quite clearly referable to this bird, it is perhaps better to drop it, as should be done with most doubtful names.

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277. Little Ringed Plover. Charadrius dubius. "Dah rooj."

Charadrius dubius curonicus, Gm. (Syst. Nat. T. p. 692—"Curonia").

Common and resident through the length and breadth of our area moving about locally after the breeding season; there is no evidence of any influx in autumn of winter visitors. Pitman found it nesting in the Euphrates marshes near Museyib on June 3rd. Logan Home met with it breeding on the river above Samarra and found several nests containing four eggs between May 21st and June 2nd. Cheesman found them just beginning to breed on the pebbly banks at Baiji in April. It probably breeds at Feluja, L. Akkarkuf, Nahr Umar and many other places. In winter it is frequently seen along the foreshore of the rivers and sides of canals as well as on the inundations and is perhaps the commonest and most widely distributed small wader.

Eight specimens examined: Baghdad, 8-10-17, 5-10-17; Khanikin, 1-8-18 (P.A.B.); Feluja, 21-3-17, 7-4-17 Samarra, 8-3-18; Baghdad, 18-8-17 (C. R. P.); Fatah Gorge, 18-4-19 (P. Z. C. and R. E. C.).

The wings of these birds measure 109·5-120 mm. and bills from edge of forehead feathers 12·5-13·5 mm.

278. Large Sand Plover. Charadrius leschenaultii, Less. (=geoffroyi auct.).

Charadrius leschenaultii, Less. (=*geoffroyi* auct.) (Dict. Sci. Nat. XLII, p. 36, 1826—Pondicherry, India).

Common at Fao where Butcher and Cumming obtained several specimens in August, February and March and where I saw a flock on March 16th.

279. Kentish Plover. Charadrius alexandrinus.

Charadrius alexandrinus alexandrinus L. (Syst. Nat., 1758, p. 150—Egypt).

The Kentish Plover is pretty common and resident throughout our area. It particularly affects the drying edges of temporary marshes and such situations are favourite nesting sites. The breeding season lasts from the end of April till the end of June; Ludlow records finding several nests at Ahwaz on April 29th. At Abu Aran, above Kurna, Logan Home found several nests in June on small sandy islets in a reed grown marsh, where also Little Terns, Pratincoles and White-tailed Lapwings were nesting. Buxton and Evans found nests at Amara on May 26th and June 5th on sandy ridges on a dried up piece of marsh; the nests were lined with a few bents and quite a number of shells which the birds had been at pains to gather, as Buxton noted that they were not common. It breeds round Basra, at the Suweikiyeh marsh and doubtless many other places.

Two specimens examined: ♀, Amara, 22-1-18, wing 109, bill 15 (P. A. B.); ♀, Sheik Saad, 18-12-16, wing 109·5, bill 15·25 mm. (P. Z. C. and R. E. C.). These both belong to the typical race.

280. Caspian Plover. Charadrius asiatica.

Charadrius asiatica asiataca, Pall. (Reise Russ. Reichs ii, 1773, p. 715—S. Tartary).

Common, but rather local, on spring and autumn passages. Pitman saw flocks of thousands on the fertile plain on the left bank of the Tigris from Kut to Azizieh in the first week of March, and on the 19th he saw a flock on cultivation at Feluja. Cheesman found it plentiful, feeding round gardens on desert land at Sheik Saad on March 26th. Cumming obtained a young one at Fao on August 11th, while Pitman saw a large flock on a semi-cultivated plain near Samarra on November 18th.

Five specimens examined: ♂, Sheik Saad, 21-3-17, 25-3-17; ♀, 25-3-17 (P. Z. C. and R. E. C.); Kut, 2-3-17 (two) (C. R. P.).

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All are in breeding dress except one ; they are finishing or have finished a body moult which seems to be complete below, but only partial on the upper parts where many feathers are worn and, as no new ones are coming through, these perhaps will be retained for the summer. The odd bird is in winter dress still.

281. Dotterel. Eudromias morinellus.

Eudromias morinellus (L.). (Syst. Nat. 71758, p. 150—Sweden).

A common but local winter visitor. Pitman noted it as common on the undulating wastes covered with grass near Samarra during the winter, where it occurred in vast flocks. It is reported as plentiful at Feluja and common in the Karun district. Elsewhere it occurs according to our records sparsely and in quite small numbers. Last record April 7th.

Seven skins examined : Arab village, 3-12-16 (P. Z. C. and R. E. C.); Feluja, 11-4-17 Samarra, 20-1-18 (C. R. P.) ; Amara, 16-12-17 (P. A. B.) ; Feluja, 1-11-17 (Ludlow) ; ♂ Khamisiyeh, 24-11-16 (Aldworth) ; Ramadie, 16-11-18 (Brooking).

282. Sociable Lapwing. Chettusia gregaria.

Chettusia gregaria (Pall). (Reise. Russ Reichs I, 1771, p. 456—S. E. Russia).

This species is a winter visitor and like the two previous Plovers it is very local, but where it occurs at all, good numbers may be met with. Logan Home recorded it in large flocks on the Tekrit uplands from October to February and Pitman met with it plentifully in huge flocks on the cultivated plain between Kut and Azizieh at the end of February. Cheesman found flocks on the desert near Tel-al-lahm 20 miles from the river. It is recorded from Basra, Ezra's Tomb, Urfa district and Ras-el-Ain. The latest record was on April 4th. Like the two previous species this bird prefers cultivated land and grassy uplands to marshes.

Three specimens examined : ♀. Ezra's Tomb, 3-12-18 ; ♂, Tel-al-lahm, 28-12-18 (two) (P. Z. C. and R. E. C.)

283. White-tailed Lapwing. Chettusia leucura. "Tatwa."

Chettusia leucura (Licht.). (Eversm's Reise v. Oremb. nach Buchara, p. 137, 1823, between Kuwan and Jan-Darja).

Very common resident, breeding round the inundations, temporary and permanent marshes ; in winter spreading further afield and some may even migrate. Unlike the last three Plovers this is a true denizen of the marshes and is never found far from water. The breeding season begins about the second week in May and full clutches are universal early in June. In the Euphrates marshes round Museyib and Hindia Barrage, Pitman came across great numbers of this species nesting in the first week of June. The nests were on the edge of the marsh or on semi-submerged islets, indeed many nests had been flooded out. So numerous were they there that he several times examined 50 to 100 nests in an hour, and a tiny islet might hold three or four nests. He describes the nest as being much like that of the Peewit ; the eggs four in number, vary a good deal in size and markings and are smaller and more clay-coloured than those of the Red-wattled Lapwing. Logan Home, who found a colony at Abu Aran on June 8th, says the nests were on the edges of islands in a marsh and usually 5 to 10 yards from the waters edge. These islands were sandy with small hillocks and patches of short grass here and there on them and were closed in by high reeds all round. The nests were of the usual Plover shape with a few bits of shell under the eggs.

He says that, unlike the Pratincoles and Little Terns which were nesting there, these birds were very wary and would not go on to their nests while he was on the island. Like the Peewit they are very noisy at the nesting ground.

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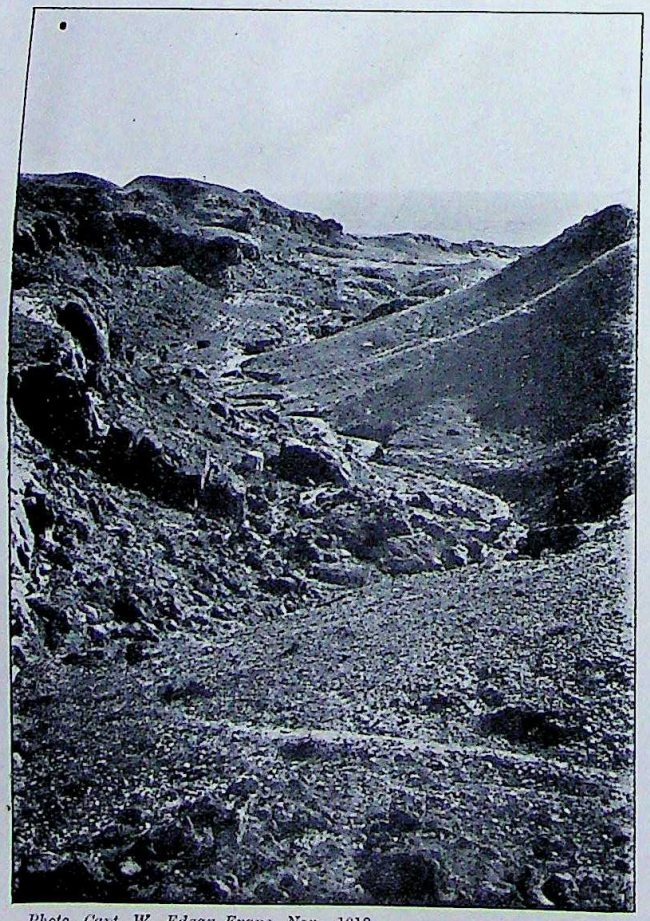

Photo. Capt. W. Edgar Evans, Nov., 1918.

A.—Valley in the Jebel Hamrin, N.E. of Baghdad. Haunt of See-see, &c.

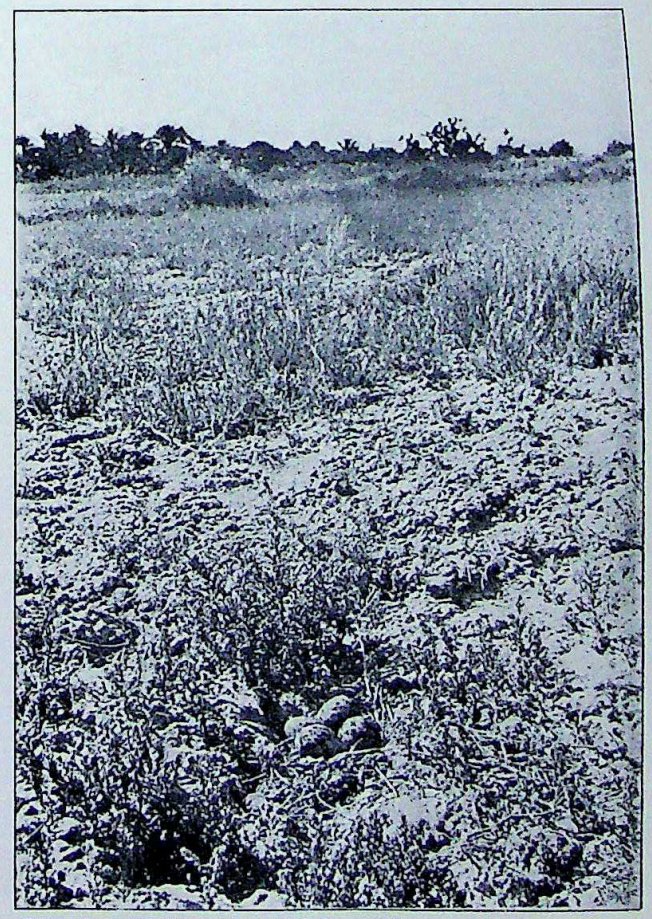

Photo. Capt. W. Edgar Evans, 17th May, 1918.

B.—Nest and 4 eggs of *Chettusia leucura*, near Amara,

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Other breeding grounds are the Suweikiyeh marsh, L. Akkarkuf, marshes round Amara, and doubtless many other places.

In the Samarra-Tekrit area where less amount of suitable ground is to be found it is somewhat local and Pitman thought many moved away from that district in winter.

Six specimens examined: Frontier of Arabistan (Wilson) ♀, Hindia Barrage, 22-3-19 (P. Z. C. and R. E. C.); ♀, Amara, 30-12-17, (two) ♀ Amara, 26-2-18 (P. A. B.); ♂, Basra, 19-3-18 (C. B. T.)

284 Red-wattled Lapwing. Sarcogrammus indicus.

Sarcogrammus indicus aigneri, Laubm. (Falco 9, p. 10. 1913—Las Belas in Beluchistan).

It is of considerable interest to find this Lapwing, which is so common and familiar to everyone in India, has spread westwards along the Mekran and Persian Gulf into Mesopotamia. It is not uncommon, widely distributed and of course resident. Unlike the Indian Roller, which has but a limited distribution in our area, this Lapwing, which can adapt itself to almost any circumstances compatible with a Plover's life, has extended throughout the length and breadth of Mesopotamia; from the Karun and Basra districts it may be traced up the Euphrates to Feluja and up the Tigris to Tekrit, Samarra and Mosul while it is found out on the Persian frontier at Shahroban and Khanikin. The breeding season begins in the middle of April and eggs are reported as late as June 6th. The nest unlike that of the White-tailed Plover is placed "high and dry," generally some little distance from water and is a mere scrape after the fashion of its kind, nor is it colonial in its nesting habits like the last named, each pair jealously guarding its own territory. In winter it is subject to local migrations.

Three specimens examined: ♀ Amara, 1-12-17, wing 229, bill 38 (P.A.B.); Sheik Saad, 2-11-16 w. 225·5, B. 36, (P. Z. C. and R. E. C.) ♂, Sheik Saad 14-12-17, w. 233, B. 38 (Robinson).

These are not to be distinguished in any way from Baluchi specimens, whence came the type of *aigneri*.

285. Spur-winged Lapwing. Hoplopterus spinosus.

Hoplopterus spinosus (L.) (Syst. Nat., 1758, p. 151—Egypt).

Zarudny records this as a rare winter visitor to the Karun district. Pitman seems certain he saw some near Kurna in January. Weigold says he saw it apparently breeding at Bambudj and Beredjik just over the Mesopotamian boundary in Syria. The status of this bird in Mesopotamia requires further investigation.

286. Common Lapwing. Vanellus vanellus.

Vanellus vanellus (L). (Syst. Nat. 1758, p. 148—Sweden).

A winter visitor in small numbers and widely distributed throughout our area. It apparently arrives late in the autumn, the first record being on October 22nd and the majority do not arrive till early November. Buxton, who found it common at Amara, noted that it disappeared at the end of February and the latest date we have any record of is March 4th. In some marshes it appears to be pretty common, but most records refer to small flocks or small numbers.

Four specimens examined:—Samarra, 13-12-17 (C. R. P.); ♂ Tekrit. 9-12-18 (P. Z. C. and R. E. C.); Amara, 27-11-17. 10-12-17 (P. A. B.)

287. Oyster-catcher. Hæmatopus ostralegus.

Hæmatopus ostralegus, L. (Syst. Nat., 1758, p. 152—Sweden).

The Oyster-catcher is not a very common winter visitor; small parties may be met with on the inundations and mud-banks of the Tigris and Euphrates in their lower reaches and it was once recorded as far north as Baghdad; at Fao

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it is probably not uncommon. There are several records of it during the breeding season, but there is no indication that it nests in our area. As it is recorded in nearly every month of the year it is impossible to say what its migratory movements are.

One skin examined : Amara, 16-3-19 (Logan Home).

288. Crab Plover. Dromas ardeola.

Dromas ardeola, Paykull (K. Sevensk. Vet. Ak. Handl. 26, pp. 182-188, 1805—India).

This, essentially a maritime species, is only known in our district in the Fao littoral. Here Cumming obtained specimens in October and eggs from the district. Probably these came from the Khor Abdulla, as Armstrong, while at Fao, ascertained that it breeds there in large numbers and had eggs brought to him on May 20th from there. From the Arab who obtained them Armstrong ascertained the following facts.

The Khor Abdulla, or Abdulla banks, are situated on the Arabian side of Fao, distant about 15 miles, in an old estuary of the Shat-al-Arab; they are a group of rocks with much mud and sand silted up in between them, and round them is a huge mud flat at low water ; on the Khor the Crab Plovers nest in colonies, excavating burrows two to four feet long into the sand, at the end of which *one or two* eggs are deposited. The breeding season is well known to the Arabs who do quite a trade both in birds and eggs in the country around. The birds are taken from the burrows, put into baskets and taken to Basra for sale ; Armstrong who tried eight of them in a pie found they were very good eating ; they had been taken from nest burrows and all were females.

This account agrees very well with that of Huskisson and Nash who visited breeding colonies on islands near Bushire (*Hume's Nests and Eggs* 4, p. 328) except that they invariably found a single egg in each burrow and I think we may take it that this is the correct number.

This aberant species lays a pure white egg, utterly unlike a wader's egg, and is very large for the size of the bird.

Comparatively little is known about the nesting economy of this bird and should any ornithologist be able to visit the Khor in the nesting season and make observations there he would be well repaid for the discomfort of the heat. Eggs may be looked for early in May and both eggs and young early in June. Spirit specimens of both chicks and adults are great *desiderata* for working out the relationship of this anomalous bird.

289. Turnstone. Arenaria interpres.

Arenaria interpres (L). (Syst. Nat. 1758, p. 148—Sweden:)

Probably not uncommon at Fao as a winter visitor. Finch obtained one on February 17th and Cumming shot one there on June 18th so that probably some non-breeding birds spend the summer there.

(To be continued.)

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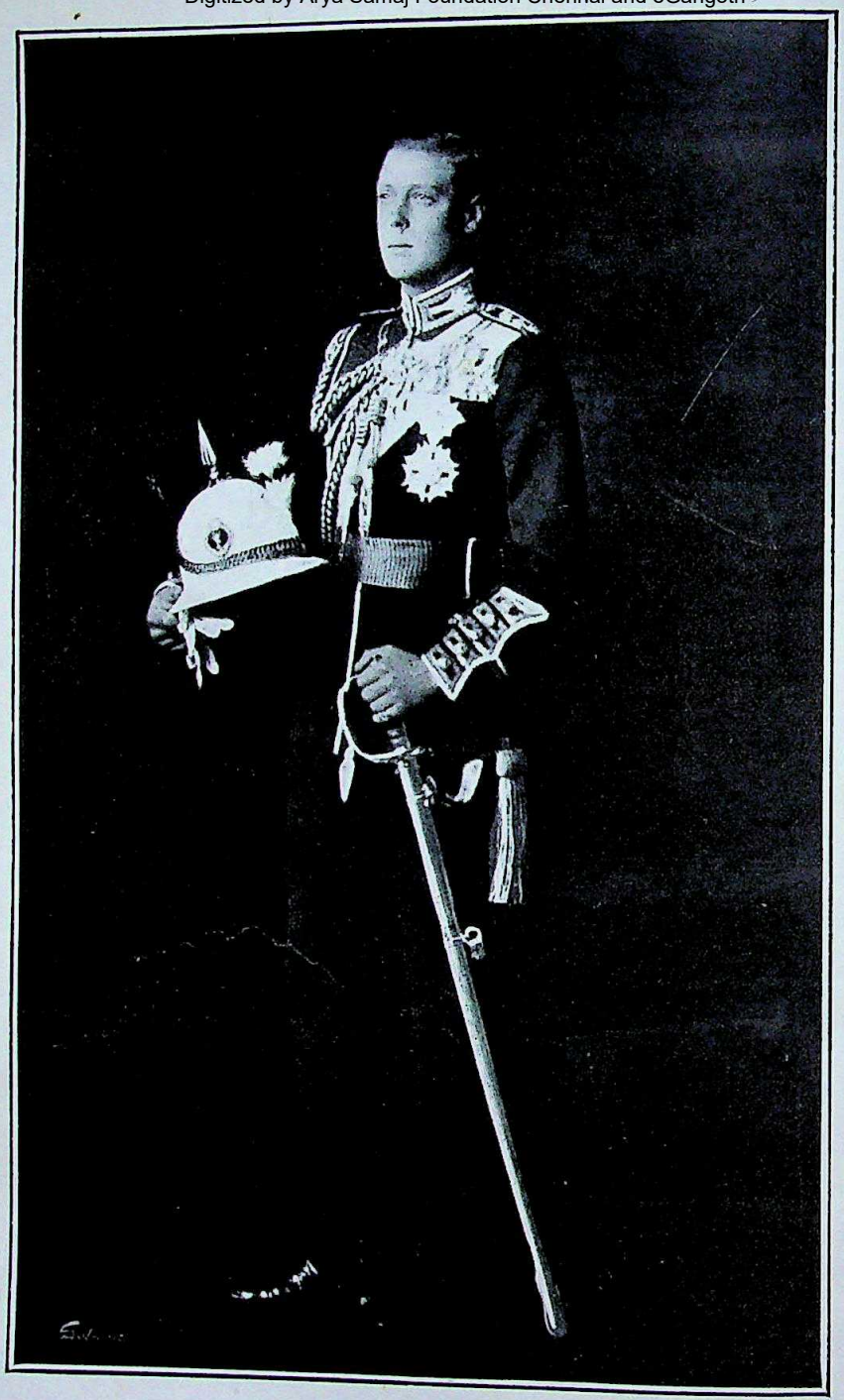

Edward P 1922.

H. R. H. The Prince of Wales, Patron and Life Member of the Bombay Natural History Society

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H. R. H. THE PRINCE OF WALES' SHOOTS IN INDIA IN 1921 AND 1922.—PART I.

By

BERNARD C. ELLISON, C.M.Z.S.—(*Naturalist to the Shoots.*)

(*With 9 plates and a map.*)

NEPAL.

To the average Englishman in India, but little is known of Nepal or its people. Brian Hodgson, to whom we are indebted for most of what we know of the Natural History of the country, gives an account of the physical characters of Nepal dividing it into 3 distinct regions according to the elevation of the several districts. The lower region consists of the Terai, or Marshes; the Bhawar or forest and the lower hills, with a climate approximating that of the plains of Hindustan, with a certain increase of heat and a great excess of moisture. Next comes the Central region composed of a "clusterous succession of mountains" varying in elevation from 3,000—13,000 feet, with a temperature of 10° to 20° lower than the plains; and, lastly, the juxta-Himalayan region consisting entirely of high mountains whose summits are buried in snow for the most part of the year and whose climate has nothing tropical about it except perhaps the succession of seasons. Before describing the arrival of H. R. H. and staff in Nepal on the 14th December and the sport subsequently enjoyed by the party, it is necessary to explain shortly the arrangements made by H. H. the Maharaja of Nepal to take the utmost advantage of the extraordinary sporting resources of his country. General Kaiser Shumsher Jung Bahadur, President of the Nepalese Committee relating to the Prince's visit and also officer-in-charge of the arrangements of the shoot, in a letter, says :—

"It was only in July (1921) that definite news of the Prince's visit to India being available, the question of H. R. H. having a shoot in Nepal was raised. The Prime Minister of Nepal had pressed the Government of India to arrange the dates of the Royal Shoot to fall in January, or better still in February, so that a better bag of big game might be anticipated, but in view of the extended tour in India and the Far East, the 14th and 21st December were given as the only possible dates. The Prince's stay in Nepal was, therefore, shorter than those of his father and grandfather.

In 1910 previous notice of more than a year had been received enabling the men to work for two seasons, *i. e.*, on either side of the rainy season to erect 2 shooting boxes and camps in the interior of Chitone for the use of H. I. M. the King-Emperor in 1911. The short notice on the present occasion compelled the Prime Minister to abandon the idea of a shoot in Chitone and consequently Pathenghetta off Bairagnia was suggested, but considering the poorness of game that side, a camp at Thon, the gate of Chitone, was finally decided upon."

The venue for the Royal Shoot was the Terai which may be classed amongst the richest and most strictly preserved game tracts in the world. The shooting camp prepared for the Prince was about 2 miles from Bikna Thori Station on the Nepal Border. It was not the same camp which was used on the occasion when H. M. King George visited Nepal. His Majesty's camp was about thirty miles away from the frontier, at a place called Kasra, where a permanent pavilion was built for the use of His Majesty. The present camp had no wooden pavilion, but nevertheless it presented a most delightful spectacle being a mass of creamy white tents shaded by giant forest trees, flanked by and overlooking the river: beyond the river lay a great tract of forest land, and still further in the distance the snow capped peaks of the Himalayas. On all the other sides jungle of the thickest kind and then the Indian frontier.

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There were really three different camps. The Royal Camp was on a plateau by itself directly overlooking the river bed. Descending from this one came to the Press Camp, which, though on a lower elevation, still commanded the same view. Opposite this was the servant's camp which housed the huge following which generally accompanys a gathering of this description. About ¼ of a mile away through the forest lay H. H. the Maharaja's camp. The locality covered by the camp before the middle of November had been rank jungle—the haunt of wild animals, which had left their tracks even after the grounds had been tramped.

Both camps, that is to say H. R. H.'s and that of the Maharaja of Nepal were surrounded completely by pallisades and guarded by Nepalese troops. Great fires were lit at night to keep away a possible marauding elephant or wandering rhino or tiger. Such unwelcome visitors were always a possibility in a spot where wild animals abounded. A further provision against incidents of this description was a machan, termed very aptly a "Funk Machan," designed as a haven of refuge in the event of a stampede of elephants or the visit of a wandering rogue. The greatest attention to detail was displayed in the lay out of the camp and every provision was made for the comfort and convenience of the guests. The roomy tents which were beautifully furnished and fronted by garden terraces flanked an open lawn scattered with chairs and tables where people might sit in the evenings. Here also a huge bonfire flared all night and a giant yule log blazed—quite the biggest I have ever seen. The whole camp, both inside and outside, was lit with electricity from the great arc lamps which hung picturesquely from the trees, under which all the trophies shot during the day's sport used to be shown before being handed over to the ministrations of my men in the skinning camp, down to the little reading lamp by one's bedside which one could switch off before turning in.

The Royal suite of apartments were simple, yet all that could be desired, and ornamented, as befitted the occasion, with emblems and trophies of the chase. The floor of the mess tent was carpeted with Leopard skins pieced together as a great mat; the effect, as can be gathered, was extremely rich and striking. The very appointments of H. R. H.'s writing table were all mementos of sport in Nepal being made up from Rhino hoofs, horns and hide, and even the waste paper-basket was made from the lower joint of a rhino's leg. One cannot but refer to the beautiful albums on the tables of the mess tent, whose pages held the photographic record of many a famous shoot in the Nepal Terai.

The Camp had a well appointed Post and Telegraph office attached to it.

On the eve of the Prince's arrival it was inspected by H. H. the Maharaja of Nepal who, though in indifferent health, insisted on previously visiting the camp with Col. O'Connor, the British Envoy, to see that everything was as it should be for the reception of the Royal Guest. Of an urbane and generous disposition H. H. the Maharaja impressed one immediately by his character brimming over with good nature and kindliness. I was also introduced to the Maharaja's sons, all of them Generals. It is the custom in Nepal, I believe, to have all Royalty created Generals practically simultaneously with their birth. I was much impressed with the youngest boy who, though only eight years of age, had a few days previously single handed accounted for his first tiger.

Very efficient arrangements were made by the Nepal authorities for the disposal of the game after each shoot, and Lieut. Hem Bahadur Rajbhandair, the Nepalese officer attached to the writer, was most helpful. The skinning camp was situated about a mile from the main camp. This was a mistake in my opinion although the reasons for it were very good and sound. The people who placed it there, considered that for sanitary reasons it was advisable to have all the skinning done as far away as possible. On all the other shoots I asked to have the skinning camp within a quarter-of-a-mile of my own tent, and accommodation for my own men provided on the spot. This worked

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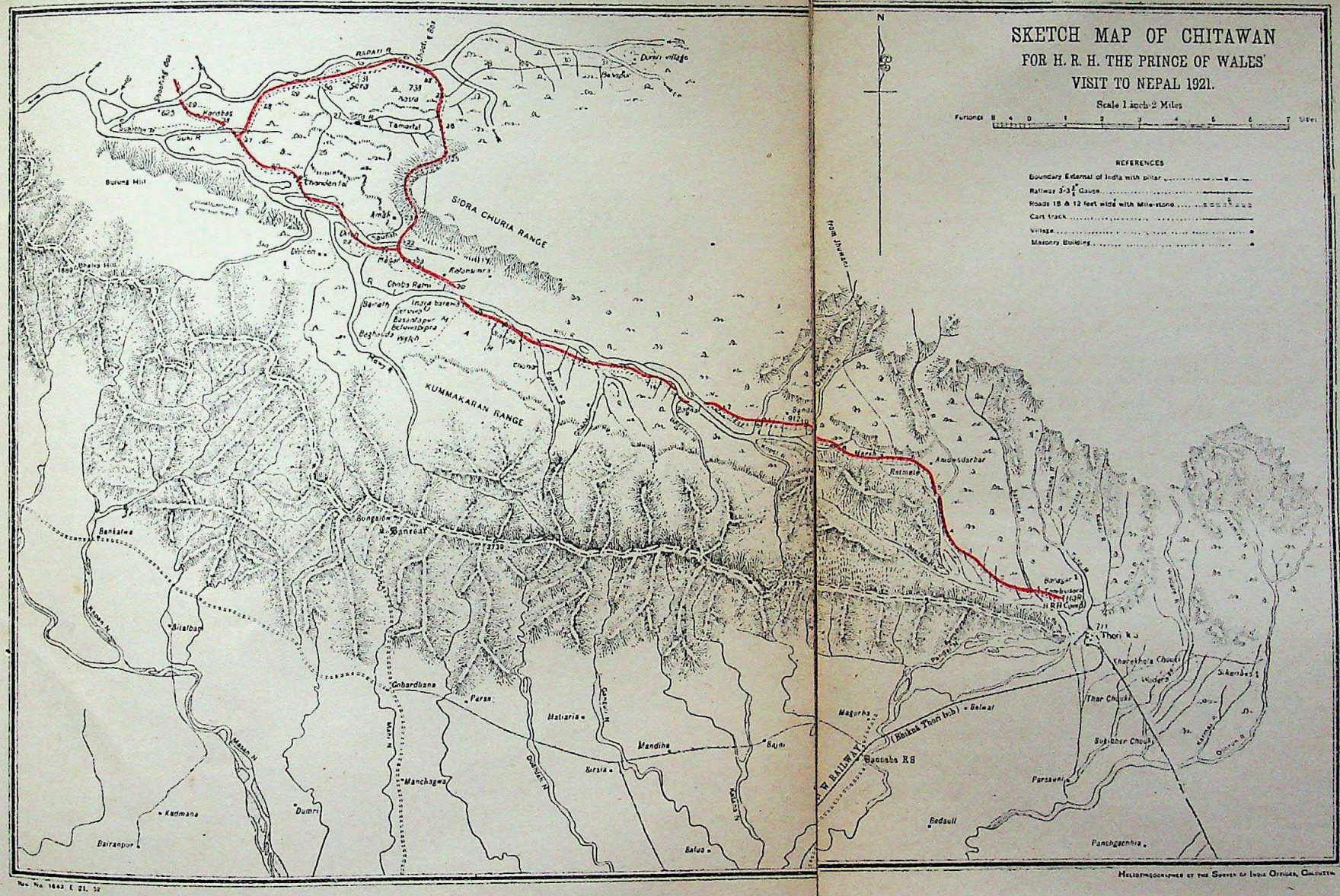

The road from the Royal Shooting Camp at Bikna Thori is marked in red. At different plac n this route most of the beats mentioned in this narrative took place. On the extreme left of the map is Kasra, where His Majesty King George V stayed, wh he shot in Nepal in 1911.

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better, I found, as, after the animals came to the camp and had been viewed by H. R. H. and the people who shot them, they were immediately and without delay sent to the skinning camp and on arrival at once dealt with by our department. In shooting on a large scale celerity in skinning is a great point, particularly in the present instance where I had only two men* with me who could be trusted to attend to the more intricate points of skinning, such as the head and limbs. We obviated difficulties as regards nauseous smell, etc., which otherwise would have made the skinning camp in Nepal a perfect Golgotha by a plentiful scattering of lime and disinfectants. However in spite of this at times, when we had five or six disarticulated rhino together with numerous tigers and an odd bear in different stages of skinning, the stench was almost unbearable.

Before describing the shooting I cannot but comment on the elaborate and extremely efficient methods adopted for giving prompt and exact "khubber" about kills and the movements of game. This was accomplished by a precise system of signalling, on a scale which I think has never been attempted before on a shoot of this description. The whole arrangement was under the direction of Lieut. Leonard, R.E., who had arrived in Nepal some weeks previously to put up a system of telephonic communication between the Royal Camp and certain suitable spots, within the forest for a radius of 30 miles. Lieut. Leonard was assisted by a party of English Sappers who during the period during which they were engaged in putting up the necessary wires and installation spent a very thrilling fortnight alone in the jungles. Considering that these jungles in normal times abound with dangerous game of all description, and that particularly at this period when in preparation for the Royal Shoot there had been a close season for some time, it can be readily understood that Lieut. Leonard and his party had some exciting experiences to recount of the time spent in the Nepal jungles. One of the receiving field stations was fixed to the trunk of a tree near by my tent and every morning on my visit to the skinning camp I would ring up for news and would be promptly informed as to the whereabouts of the last "Kill" or the location of a tiger 10 or 15 miles away. No rhino was untracked or tiger left to itself. The rhino no sooner began to doze off as the sun grew warm, as is his wont, than the tracker climbing up a neighbouring tree made signs to his mate on the ground who ran off to flash the news by the nearest telephone station.

I give the following extract from my diary of the first day's shoot :—

December 14th.—At Biknathori to-day the camp is aglow with excitement from early morning. I was awakened by the trumpeting of elephants and the shouts of an army of Nepalese attendants. I watched the little Gurkhas passing to and fro near my tent. What a noise these stout little fellows with the Kukris make ! Talk is of nothing else but the arrival of the Prince and the prospects of the shooting. A very large tiger had been seen and it was hoped that it would fall to the Prince's rifle. Shortly after 9 a.m. a fanfare of bugles announce the arrival of the Prince. The Nepalese Guard present arms and the Royal Car sweeps into the camp followed by the cars of his suite. The Prince steps out, looking remarkably well and boyish in light khaki Jodhpur breeches, shooting coat, and Sambhar leather shoes. A few minutes were spent in introductions. Then off we all go in the cars to the shooting beat. This is quite near the camp, at a place called Sarasvati Khola. We get out of the cars and mount the pad elephants which take us to the line of elephants, with howdahs, in position by the river bed. His Royal Highness mounts into his howdah which, by the

* I brought with me from the Natural History Society two skinners—N. A. Baptista, a Goanese skinner of considerable experience who for many years had been in the employ of the Society, and my servant Rawjee Kaneira, a Hindu, who had a knowledge of skinning. Under my supervision they did all the skinning in the principal shoots in India and Nepal and worked exceedingly well.

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way, is the same as was used by his father when he last shot in Nepal. The rest of the party are the Earl of Cromer, Admiral Sir Lionel Halsey, Col. Worgan, Lord Louis Mountbatten, Capt. the Hon'ble Piers Legh and the Hon'ble Bruce Ogilvy and myself. Every-body is expectant though nothing happens for sometime. On the other side of the huge river bed, now reduced to a narrow stream, stretches the jungle for mile on mile. It is very hot, the elephants are impatient and every now and then one of them gives utterance to restless trumpeting. Suddenly there is a movement on the left hand side of the line and General Kaiser, the Master of Ceremonies, who had organised all the Shikar arrangements in connection with the shoots, rides in on a fast trotting pad elephant with news of a tiger and off we start. The elephants move forward with their wierd lumbering gait. H. R. H. leads the procession : followed immediately by the party and then an army of pad elephants, and still more pad elephants to be used in case of accidents. Ponderously the line proceeds through the dense jungle, crossing many a placid stream, and emerging at times from the cool shade of the giant trees into some glade where the sun beat hot and fierce, only to plunge again into the cool depths of the evergreen jungle. One is instinctively impressed with the calm and twilit grandeur of these gigantic forests. Within their depths all is stillness and no movement is discernible. There is nothing to break the monotonous tread of the elephants save an occasional burst of drumming from cicadas whose shrill music subsides as quickly as it rises. Suddenly there is a stir in the line. All the elephants begin to close up, shoulder to shoulder, and the great beasts stand to form the ring. All is expectancy : there is an outburst of shouting from the beaters : out rushes a deer and escapes terrified into the jungle shortly followed by another and another. Then the real thing happens and there is a cry 'Bagh, Bagh' from the beaters. The tiger at last! A glimpse of a yellowish form is seen in the long grass for the space of a few seconds and is at once lost to view. Once again it is seen behind a tree trunk. Closer advance the beaters, the tiger charges out, but he is a wary beast and seems to know intuitively where the guns are posted and gives them a wide berth. Again and again he is driven out only to seek cover in the long grass away from the guns. A Shikari climbs a tree and pelts him with stones. The manœuvre succeeds, and once again we get a half length view of 'stripes' as he makes a spring at his tormentor in the tree top. The ring closes in upon him, but with a roar he dives into the long grass ; another roar and he shows himself quite near the Royal howdah. A moment's suspense and H. R. H. fires and a second afterwards two more shots ring out. The Prince has hit. The tiger though mortally wounded has plenty of go in him and charges to the opposite side and is buried once more in the heavy cover. The ring closes in : a shot rings out : and the tiger rolls over dead. I descend from my howdah and measure him. It was a striking scene this great circle of sportsmen, beaters, mahouts and elephants, waiting in silence while the measuring was done. The tiger taped 9 feet but he was a royal beast and looked splendid when I saw him later stretched out for the Prince's inspection near the great log fire in the Royal Camp. In the evening we had news of three more tigers having been shot by another party who had gone farther afield. There appears to have been much excitement, and no little risk, experienced on the occasion, as several of the party were filled more with zeal than with experience of tiger shooting, guns were pointed in all directions and the poor tigers eventually succumbed to a perfect fusilade of bullets. One of the members of the party contributes the following description of the exciting episode :

"The tigress came out straight towards my elephant, but turned very quickly to its own right, and I fired just as it turned back into the jungle. I hit it on the near quarter, and broke its hind leg with the first barrel. The second barrel I fired as it was disappearing in the jungle and from what we

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H. R. H. the Prince of Wales mounting into his Howdah on the first day's shoot in Nepal.

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On the trail after Rhino.

Elephants crossing a stream.

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found afterwards apparently hit it on the tip of the tail! There was a great difficulty in stirring the tigress out again from the jungle, so we went in on our elephants when she suddenly came out and charged the elephant P. was on, which turned round so quickly that P. sat down on his topi and squashed it flat. The tigress was finished off, I think, by H. but I am not quite certain."

After dinner I went down to the skinning camp to see what had been done as regards the disposal of the trophies. It was an eërie experience tramping through the heavy jungle after nightfall. Of course in the present instance, with so many people about, there was not much danger though everywhere one saw the pug marks of tiger, and the tracks of elephants. Thanks to the efforts of my men the work of skinning the various trophies had been satisfactorily concluded and so with an easy conscience I went to bed.

December 15th.—To-day was fixed for the first rhino shoot. We did not get off till 10 a.m. as there were several delays. Even after a start had been made there was a stoppage caused through a huge lorry breaking down on the very steep hill leading up to the entrance of the camp. None of the cars could get past the obstacle and there was nothing for it but to get out and push, and H. R. H. was the foremost of all in helping. At last we were all speeding along bumping over the forest road that had been specially constructed for the purpose of the shoots. The first part of the journey was through a dense piece of jungle. One realised how difficult a task a hunter would have in bringing his quarry to bag in a forest of this description. This is one of the main reasons why the 'ringing' method of hunting tigers is practised in Nepal. The dense jungle found in the foot hills of the Terai must be seen to be appreciated. Massive elephant grass up to 20 feet in height, and so thick as to almost obscure the elephant from the view of the Howdah occupants in his passage through it. Often it is not possible even to see the next elephant though it is only a few yards away. Our destination this morning is Thoba, a run of 20 miles by motor. The road led for the most part of the way through the cool depths of the forest till the vicinity of Thoba was reached. Here the country was open with fields of yellow mustard on either hand. The *machans* erected in their midst told of the eternal warfare waged by the ryot against the jungle denizens. At the 22nd milestone we leave the cars to mount the pad elephants. Besides H. R. H. the party includes Lord Cromer, Admiral Halsey, Col. Worgan, Capt. Ogilvy, Lord Louis Mountbatten and myself. H. R. H. looked rather tired, as even after yesterday's long journey and long shoot, he had been playing polo at 6 a.m. Before arriving at the spot where the ring was formed it transpired that the tiger had broken back. Shortly afterwards the elephant in which the Prince was riding got bogged in crossing a stream and H. R. H. transferred to an ordinary pad elephant. The sight of a line of elephants crossing a stream is always impressive. I call to mind as I write, the stately array of elephants crossing the Thute river at sunset, the great grey beasts plunging through the swirling water, the red light of the setting sun, and the dark forest background, all combined to make an impressive and unforgetable picture.

One quickly gets accustomed to elephants as a means of transport. A pad elephant is generally the most comfortable and certainly the best as far as celerity goes, though possibly not the safest, as in the case of a charging tiger the man on the pad takes his chance of being mauled. All honour to the plucky mahouts who guide these great beasts sticking gamely to their posts often in moments of extreme danger. Many have paid with their lives for their coolness and daring. In fact one of the brave fellows was killed on a pad elephant a few days after the Prince's departure. The occupant of a howdah is practically safe from the onslaught of a charging tiger, but there is one risk which is always present in shooting from an elephant in heavy forest and that is the possibility of the

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elephant taking fright, and bolting when mahout, howdah and occupants stand a very good chance of being swept away in the headlong rush of the beast through the jungle. To return to what happened. The party arrived at the spot where the shooting was to take place at 1 p.m. and an adjournment for lunch was agreed to with general acclaim. Several rhinos had been seen in the swamp in close proximity and the chances of a good afternoon's sport seemed assured. After lunch we mounted our elephants and it was not long before a rhino was discerned in the thick grass cover. H. R. H., whose position was rather disadvantageous, since he could scarcely see the animal from where he was, fired. Lord Louis Mountbatten fired immediately afterwards and the rhino made off. A prolonged search was made for the beast. The blood-spattered leaves and grass showed clearly that the bullet had found its mark, but it was not till many days later that the beast was picked up dead. It was then too decomposed for preservation, but the skull and horn were recovered. It proved to be the best of all the rhino heads obtained in Nepal during the present shoot. A second rhino wounded on this day by Capt. Dudley North was picked up later under similar circumstances. As we blundered through the dense forest in search of the wounded rhino one could not help thinking of what would have been the effect on our ranks, if a rhino took it into his head to charge, bunched up as we were at the moment. The consequences would have been rather disconcerting as the resultant stampede would not exactly have been a pleasant experience.

Just before the search was abandoned a tiger was seen, a ring was immediately formed and the animal was soon accounted for. H. R. H. fired at the beast but missed. The tiger took cover, but immediately reappeared giving Sir Godfrey Thomas a broadside shot at close range.

Shortly afterwards H. R. H. returned to camp, but certain enthusiasts remained till dark without any results beyond a rather exciting five minutes with a pig. In the fading light an animal was discovered moving in the bushes. Everybody thought it was a panther or a tiger, a ring was formed. Whatever it was, it took a great deal of dislodging, but at last with a protesting squeal out rushed a much harassed and disgruntled porker who promptly dodged through the lines of elephants and vanished into the jungle.

Friday, December 16th.—There were several different parties on this shoot. H. R. H., Col. Worgan, Capt. the Hon'ble Piers Legh, Commander Newport and Lord Louis Mountbatten motored to the 13th milestone to a place called Bagliae. A ring had been formed about a half a mile from the road and after the party arrived H. R. H. himself posted the guns placing them at intervals of about 50 yards. Shortly after the beat commenced, a tiger broke in front of the Prince's howdah. H. R. H. fired and was immediately followed by a right and left from Capt. the Hon'ble Piers Legh. The next 20 minutes were spent in an effort to dislodge the beast from some heavy cover. Very suddenly "Stripes" put in a second appearance, but a shot in the leg from Mountbatten sent him limping back into cover. The ring now closed in upon him and the tiger making his last bid for liberty sprung gamely at Lord Louis' mount and was dropped with a shot through the head. A subsequent examination showed that only the last two shots had taken effect and the trophy accordingly went to Lord Louis Mountbatten. H. R. H. returned to camp after lunch while the remainder of the party went off on a fruitless quest after tiger.

A second party consisting of the Earl of Cromer, Capt. Dudley North and two others spent the morning after rhino at Kasra. One was secured which fell to Capt. Dudley North's rifle. The party went into some very thick jungle bordering a lake where the shikaris had previously located a few rhino. The rhinos were heard moving about as the elephants approached

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H. R. H. WAITING FOR THE TIGER TO BREAK COVER.

THE LINE OF ELEPHANTS MERGING FROM THE JUNGLE

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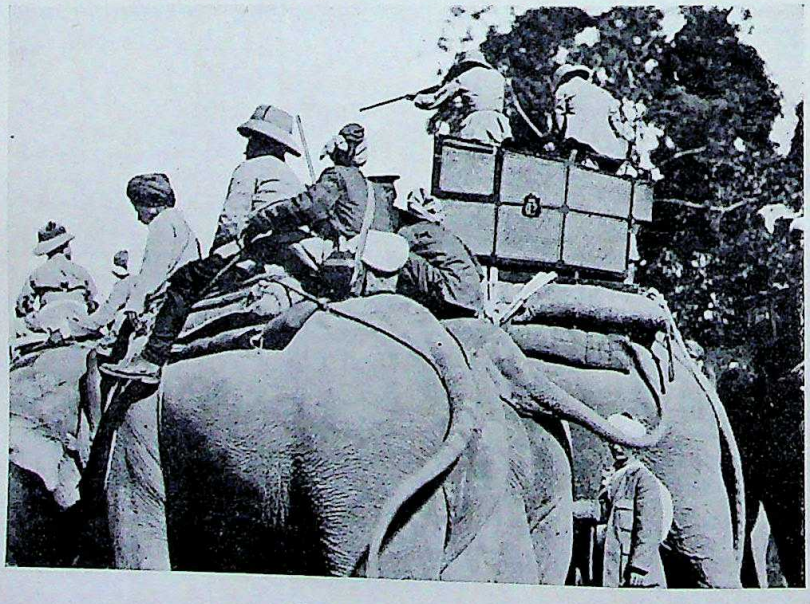
THE ROYAL ELEPHANT IN A TYPICAL RHINO SWAMP



H. R. H. TAKES A SHOT.

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and presently one of them was seen by a young member of the Maharaja's family, in the howdah with Capt. Dudley North, who urged him to fire. Capt. Dudley North had previously won the toss for the first shot and the occupant of the adjoining howdah who had also seen the animal excitedly pointed him out: Capt. Dudley North writing to me said:

"I could see nothing and told my friend so, he however still urged me to shoot. I could not see anything so I aimed at what I presumed was the object he intended and fired. Absolutely nothing happened and the conglomeration of the tree stump and grass which might have been or looked like a rhino remained exactly where it was. Even the real rhinos in our vicinity did not stir. We continued groping about in the big grass and shortly afterwards two rhinos dashed out of the pool away from us and in an impossible position for a decent shot. We tracked them for some distance, and were in a small clearing on the edge of some very high grass when we observed a great commotion going on near by. The top of the high grass was violently agitated as though some great beast was pushing through and there was no doubt that a rhino was coming our way and shortly afterwards he did, with a rush, charging straight at my elephant. The high grass parted and directly I saw the horn on the top of his nose, through the dense cover, I fired. Lord Cromer, on my left, fired two barrels in quick succession and my elephant wheeled round immediately I fired, and was for getting out it, so I did not have much time to see exactly what happened. The impression was that the rhino stumbled and almost fell but recovered and made off through the grass. Lord Cromer was of the same opinion and thought both our shots had taken effect. In the confusion of elephants trying to bolt no one had time to shoot at another rhino which came out on our right but went back into cover very quickly. There were blood traces which we tracked for some time but eventually lost. This rhino was picked up dead some days after the Royal party left Nepal."

After the above incident the party formed into line moving slowly through the jungle. Shortly afterwards a rhino was seen and very fortunately bagged by Capt. Dudley North. The beast was hit through the spine half way down its neck and dropped in his tracks needing only another shot to give it its quietus. Capt. Dudley North was using a double-barrelled ·470 Gibbs Rifle with a solid bullet.

Admiral Halsey with a party consisting of Sir Godfrey Thomas, the Hon'ble Bruce Ogilvy and Col. Harvey secured a tiger late in the afternoon of the same day. The morning had been blank and after lunch a second attempt was made. A very long trek through dense jungle where everyone got more or less lost, brought no result. So a man was sent ahead to reconnoitre; it seemed that all arrangements had failed, and a return to camp was decided on at 4 p.m., a few minutes after however 'Khubber' was brought that a tiger had been ringed quite close by. Soon all the guns were in position and a few minutes later Admiral Halsey bagged his tiger with a shot through the neck.

Saturday, December 17th.—H. R. H. spent the morning after small game and with his party accounted for some 25 head. The Admiral, Col. Harvey and Lord Louis Mountbatten motored to Kasra (30 miles) after rhino. They saw none and had a tiger beat which was also blank. The same morning Capt. Poynder and Capt. Dudley North both had a shot at a rhino which fell to the former's rifle. She was a gravid female. When it was being skinned a calf was found *in utero*. The animal gave no trouble and did not charge, but as Capt. Dudley North afterwards said "she took a terrible lot of killing."

The rhino shoots in Nepal showed very clearly the extreme difficulty of bringing these animals to bag without a vital shot. In the dense swamps of the Terai a wounded rhino is practically impossible to track and recover. In the present instance the rhino was spotted in a strip of grass jungle

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flanked on three sides by forest and on the fourth by a watercourse. 'Stops' were posted in trees on two sides and Capt. Poynder and Capt. Dudley North walked their elephants through the thick grass to a point from which the animal could be seen. The rhino moved off on their approach, but was turned back by the tumult raised by the stops and blundered back to within 10 yards of the guns. It was extremely difficult to see in the heavy cover but both Capt. North and Capt. Poynder fired, putting 4 high velocity ·470 bullets into it. The rhino lurched forward but got away and was again turned by the stops, some 200 or 300 yards off when the brute was finally dropped with a shot through the neck from Poynder's rifle. All five shots had taken effect. Four of them in the region of the shoulder. The shot in the neck had finished it. But for this, and the 'stops' posted in the trees, the animal would have got away in all probability to perish miserably in the trackless swamps. A shot in the vertebrae in the forepart of the neck will drop a rhino in his tracks. This and the brain shot would seem to be the most effective. Mr. Percival Landon shot his large bull rhino at a 100 yards with a single bullet from a ·350 rifle, placed three or four inches in front of the root of the ear.

Another party consisting of Col. Worgan, Mr. Petrie, Sir Godfrey Thomas, Commander Newport and Capt. the Hon'ble Piers Legh left camp on elephants late in the morning. They went down to the river bed from Bikna Thori Station about 4 miles and changed from the pads into howdah elephants. The ring was formed and very soon a fine tigress gave Sir Godfrey Thomas a shot. "It was not a difficult one," wrote Sir Godfrey later, "and Rushbrooke Williams who was in my howdah is certain that I hit it. Personally I am not at all sure as my elephant had no guts and turned round and more or less bolted as soon as the tiger appeared. I was on the floor of the howdah and Rushbrooke Williams nearly fell out while the elephant began to make for the woods. Luckily the mahout stopped the brute and we got back near the line to see the tiger down with everyone shooting at it. It took an awful lot of lead to kill it stone dead. An uproar then began down the line and we discovered that there were two cubs outside the ring. The line closed in upon them as we had an idea of taking the beasts alive, but they were too big to catch without nets and a good deal of preparation, and too young to leave, as in all probability they would not have lived without their mother. Col. Worgan got one and Commander Newport the other. All the way home the jungle was beaten but nothing was seen."

A tiger measuring 9 ft. 2 inches was also shot by Capt. Bruce Ogilvy on this day.

Sunday, December 18th.—It being Sunday there was no shooting to-day, and this was rather a relief to my skinning department, which had been working at high pressure the last few days getting rid of the great mass of material that had been sent in. I was up all night with my men, as, with so much already having come in and with great disarticulated limbs of rhino arriving continually I had to work against time to prevent anything being spoilt. Day and night operations thus became the order. We had a generous supply of disinfectants which were scattered with a lavish hand, but even so it was an obscene business and not to be dwelt on more than is necessary. An entry I saw in the diary of a member of the staff succinctly describes the case. "I visited the skinning camp where Ellison is dealing with the stuff; there was an appalling stink there ! ! !" The skinning camp was guarded day and night by Gurkhas. Tigers' claws, whiskers and fat and kindred articles are of much value to the native who has uses for them not dreamt of in our philosophy and with such a profusion of riches lying about one had to guard against the intrusion of the "snapper-up-of-unconsidered-trifles." One such gentleman we caught red-handed and his subsequent fate at the hands of the Nepalese officials was a sufficient deterrent against attempts of this nature. Anent the tigers fat. To me came

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diverse petitioners pleading for a modicum of the precious adipose, reputed as a panacea for many ills, but as Pharoah of old to his starving Egyptians, I commended them to Joseph, in this instance Baptista, my head skinner. To him in the course of his labours had fallen a bountiful harvest of the desirable unguent and to the waiting multitude he bestowed his favours, with, I am afraid, a somewhat niggardly hand.

Sunday afternoon was spent in the distribution of gifts and mementos from the Maharaja to his guests. Among these were a number of beautiful silver mounted kukris which were presented to various members of the party, a fitting memento of their days in Nepal. According to time honoured custom H. R. H. was the recipient of a number of live animals and birds. A list of the collection is printed at the end. Among the animals was the famous 'unicorn' sheep of Nepal. These are normally two horned. When quite young the horns are bound closely together so that they grow up in contact with one another giving them the desired "unicorn" effect. The birds included a very fine series of pheasants. Particularly striking were the gorgeous Monauls, the Tragopans with their crimson white-spotted breasts, and the little Blood Pheasants in green splashed over with blood-red markings. After being inspected by the Prince the collections were finally handed over to the writer and at the close of the shikar in Nepal were brought down to Bombay where the animals and birds were temporarily housed in the Victoria Gardens previous to their being shipped to the London Zoo, their final destination.

Monday, December 19th.—On this day His Royal Highness shot a rhino at Sarasoti Kola. Capt. Dudley North describing the shoot writes :

"I went out with H. R. H. after Rhino. We went to where one was reported and soon sighted a Rhino lying down. H. R. H. had not seen one properly before so that at first he did not recognise it as they are so difficult to distinguish in heavy cover. However when the brute rose he saw it. The Rhino moved slowly towards us and I suggested his firing a raking shot into it, but H. R. H. very rightly preferred to wait for a more advantageous position. The Rhino turned to the right and the Prince fired. His first shot hit, though rather high, and the beast swung round and H. R. H. fired again hitting it this time on the neck. We followed the beast into very heavy cover, but the trees were so thick that it was impossible to get a clear shot, the elephants were just getting clear of the trees when the Rhino was dropped by one of the Nepalese officials* who had fired as he was under the impression the beast was going to charge. H. R. H. used my ·470 Gibbs Rifle which I lent him."

A separate party consisting of Sir Godfrey Thomas, Capt. the Hon'ble Bruce Ogilvy and Lord Louis Mountbatten spent a fruitless morning after Rhino at Kasra. The day was not without its excitement however, as in the course of operations Lord Louis Mountbatten's elephant suddenly went 'musth' while he was in the howdah. The party was going through what one of them described as "the longest and thickest grass I have ever had the misfortune to encounter" it was several feet above the head of a man standing up in a howdah. Without any appreciable warning Lord Louis' elephant attacked another animal on which a Nepalese Colonel was sitting and disappeared into the bush. Fortunately the mahout managed to stop him by slashing at his head with a kukri. Lord Louis was then rescued and transferred to another elephant. After that the party went through "still worse country"; the noise the elephants made crashing through the tangle of tree and grass was sufficient to scare any game within a radius of miles, so the shoot was abandoned and the party retired to the base and motored back, reaching camp long after dark.

Near Dhoba, one mile to the south of the 22nd milestone, the same morning Mr. Percival Landon, who was with another party, bagged a fine bull rhino with a single shot clean through the brain. I am indebted to Mr. Percival

* General Kaiser Shamsher Jung Bahadur.

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Landon for the following graphic description of the day's sport. "The Rhino was shot after the first ring at which Lord Cromer secured a fine leopard as well as the largest tiger that had yet been shot; the party divided as the beaters had reported two finds three or four miles away—some animal, probably another tiger, cornered in a dense bit of jungle, and a rhino in an open plantation. Mr. M. A. Metcalfe, Capt. Poynder and Mr. Percival Landon went after the Rhino on elephants. By this time the sun was getting low. They made their way across more or less open country for about two miles and then entered the plantation. This was irregular in character. large woods of free growing young *sal* alternating with treeless stretches of coarse shoulder-high grass indicating swampy soil, the whole being surrounded by a ring of thick and sometimes impenetrable undergrowth. The light was fading, tending to become yellow, a fact which only enhanced the unusual beauty of the surroundings. The party moved forward in silence broken only by the steady crash of what light undergrowth there was under the *sal* trees, or the tear and the squish of the high marsh grass. Several times, where the mud was exceptionally deep, they came upon signs of recent wallowings, but of rhinoceros they saw nothing though they spent over an hour in carefully quartering the plantation in response to the noise and whistles of the beaters on foot. They were on the point of giving up and returning to the rest of the party when a soft but insistent whistle some distance to the right turned them back for a last chance. Mr. Landon was on the right hand elephant with a Nepalese officer and slightly in advance of Mr. Metcalfe and Capt. Poynder, when he suddenly came in sight of a huge rhino. He was standing sideways motionless among sal trees well lighted for a shot. He stood about 6 feet high, and as roughly paced out afterwards, was 9′ 10″ in length. In the low evening sun he looked as big as a locomotive. Mr. Landon fired twice, the first bullet hitting it nearly opposite the centre of the spine, though whether the bullet did much work through the plate at that angle one cannot say. It did not seem to have any effect. With the second shot he hit it clean through the brain and the rhino sunk down in his track, without a movement, stone dead. The distance was just 90 yards and everybody came up to find the beaters already closed in and celebrating the occasion, with the amazing rites that always accompany the killing of a Rhinoceros in Nepal. Everything that could hold blood was requisitioned and the thick blood flowing from the nostrils was collected with the utmost care. This was not a concession to the spirit of the monster, as in the rite of the dabbling of a tiger's whiskers in his own blood. A Rhinoceros's blood is apparently unrivalled as a viaticum for the dying, ensuring for the soul both a peaceful departure and a happy rebirth on the other side. There are indeed many superstitions about a dead rhinoceros, but it is worth noting that its power for ensuring peace for the departed soul is retained by the mere empty shell—it is hard to call it skin—of the beast for years after its own decease. The scene was a strange one and Capt. Poynder aptly re-called the prehistoric association of 'Tarzan of the Apes' as half a dozen elephants closed in from nowhere and ranged about the inconceivable scene of blood ritual which was carried a step further by the decapitation, amid fountains of blood, of the beast's head. There was no time for witnessing the 'gralloching' of the carcase, another messy and obscene ceremony of great importance. The head was measured from the top of the snout to the fold of the hide over the jaw bone and found to be a shade over 30½ inches straight. The horn was of no great height perhaps 8 inches but of massive construction. The colour was of an unusually light grey and the only mark on the head was that of the ·350 bullet three or four inches in front of the root of the ear."

In the afternoon news was brought to the Camp that a tiger had been ringed about six miles out; the following party therefore went out after him:—

H. R. H. The Prince of Wales, Col. O'Connor, Captain Dudley North, the Hon'ble Piers Legh, Captain Ogilvy and Captain Villiers.

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H. R. H. TAKES A HAND WITH HIS KUKRI IN DECAPITATING A RHINO.

A FURTHER STAGE OF THE RITUAL.

The dismembered head of the Rhino is seen on the right of the pothograph. H. R. H. is an interested spectator at the ceremony.

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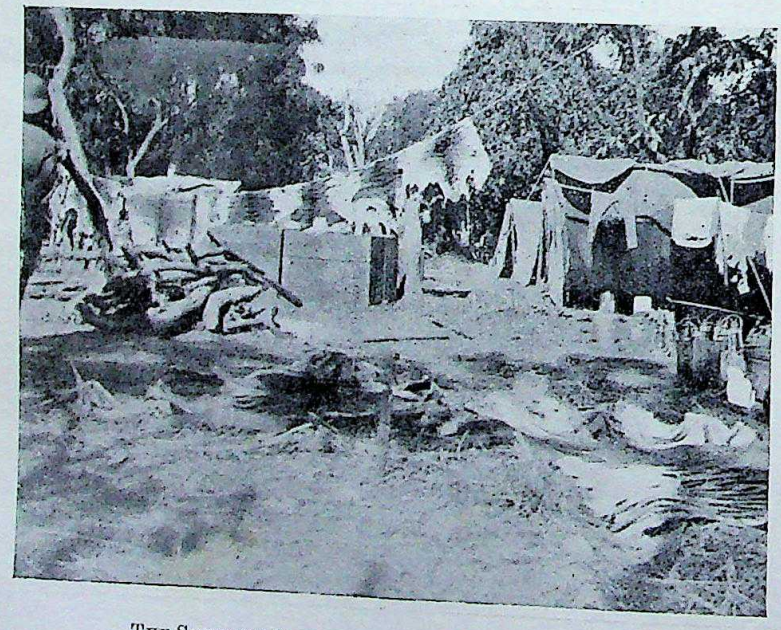
PEGGING OUT A TIGER SKIN.



THE SKINNING CAMP AT THE CLOSE OF A DAY'S WORK.

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In about three quarters of an hour the party reached the spot where the tiger was surrounded, the ring being a fairly large one and the jungle in the middle unusually thick. The tiger, or tigress as she turned out to be, gave very good sport and was finally bagged by Captain the Hon'ble Piers Legh, who dropped her with a very fine running shot clean through the heart.

Information was then brought that there was another tiger not far off, which there was a chance of ringing if people liked to hurry out, but as it was getting late and the chances were not very great of reaching the spot in time, His Royal Highness and Col. O'Connor returned to the camp. The remainder, however, went on, on the off chance and after they had plunged into inordinately heavy jungle for the space of a further half hour, came to the spot where the Shikari said the tiger should be, and started trying to ring him. Captain Villiers thus describes what happened :—

"I suddenly saw a tigress cantering quite slowly diagonally across towards my elephant and after waiting till she was within easy range I fired and got her through the shoulder dropping her immediately, but not killing her outright since the shot just missed the heart ; I finally despatched her with a second shot. I was shooting with a ·22 bore double-barrelled rifle made by Messrs. Manton & Co., which, I may mention, is without any exception the nicest weapon I have ever handled ; it comes up to the shoulder just like a well fitting 12 bore and it was interesting to see how effectually this extremely small bore, but very high velocity weapon stopped the tigress. She proved to be a tigress measuring 8 ft. and was in excellent condition."

Judging from the trophies received at the skinning camp, this day, Monday, December 19th, provided the most successful sport.

In addition to the rhino bagged by H. R. H. and the one shot by Mr. Landon a third rhino was accounted for by Commander Newport. The Earl of Cromer shot a fine tiger, the largest obtained in Nepal, during the Prince's shikar taping 9′ 10″, and a leopard. All this meant a considerable amount of work for my men, but it is to be recorded that they carried it through with the utmost zeal and fervour.

December 20th.—H. R. H. did not go out in the morning but remained in camp till after lunch when he rode out with Sir Godfrey Thomas and a few others into British Territory where he shot small game.

Lord Louis Mountbatten and Col. Worgan motored to the 22nd milestone at Dhoba where a rhino was shot by the latter. They then joined up with Col. Harvey, Col. O'Kinealy and Capt. the Hon'ble Piers Legh and went to a tiger ring which proved to be blank. Later a ring was made for panther and provided an exciting evening. On the elephants beating the ring a bear was found who caused a great deal of amusement charging round the ring and giving every one a chance of a shot. The shooting appears to have been "promiscuous," but it is to be recorded that the bear eventually succumbed. After the firing subsided the presence of the panther became a matter of doubt as he had not put in an appearance during the tremendous bombardment of Bruin, but on the ring closing up they flushed him, and he charged straight through the elephants and broke the ring. He was hit by Sir Geoffrey de Montmorency but was not deterred in his charge, and went straight through. The ring reformed rather raggedly, and the panther again broke through springing on an elephant's trunk. He was dislodged but it was too dark to continue that evening and was shot the next day and proved to be a fine animal taping 7′ 6″.

Lord Cromer and the Hon'ble Bruce Ogilvy each accounted for a rhino in the course of the day and Capt. Poynder bagged a bear just outside the Royal Camp.

December 21st.—This was the last day of the Nepal shoot. H. R. H. rode out after lunch with Col. O'Connor, the British Envoy, Sir Godfrey Thomas and others.

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In the course of the evening, near the village of Persanni, in British Territory, the Prince encountered a Hamadryad or King Cobra which he luckily killed. The party were walking up jungle fowl at the time. H.R. H. first shot at the snake as it was moving away and apparently hit it, for the brute turned and appeared to be about to attack him when he killed it with his second barrel. The snake was brought into camp with the rest of the day's bag. It was first assumed that it was an ordinary Rat Snake or Dhaman when examined in the fading light. Subsequently when the skin was examined at the Society's Museum in Bombay the identity of the reptile was revealed. The Prince's King Cobra taped 10′ 3″. The Hamadryad, the largest known poisonous snake in the world, grows to about 15′ in length. The record specimen now in the Society's Museum measures 15′ 5″. Much has been written about the ferocity of the King Cobra, and its propensity for making an unprovoked attack. When cornered a King Cobra may show fight, or a female will very probably attack should her nest or eggs be endangered, but experience has shown that these serpents under ordinary circumstances usually seek safety in flight.

On the 21st morning a party consisting of Lord Louis Mountbatten, Sir Godfrey Thomas, Admiral Halsey, Col. Worgan, Commander Newport, Col. Harvey and Mr. A. Metcalfe went down to Dhoba near the 20th milestone where a tiger had been ringed. The following is an extract from Sir Godfrey Thomas's Diary :—

"The ring was in very thick jungle and we spent sometime in getting the elephants to trample down a patch in front of each gun. Nothing happened for sometime till we got a fright when a big pig suddenly dashed out. Shortly afterwards we heard a tiger woofing in the middle but he could not be seen. Suddenly he appeared in the same place as the pig, and was just coming out when Mr. Metcalfe got him with a very good shot in the head. He could not see where he fell but he subsequently proved to be stone dead. Metcalfe was all for getting down to have a look at him but as they shouted out that there was another tiger in the ring we quickly resumed our places. Sure enough a tigress came dashing out again by an extraordinary coincidence right in front of us. Metcalfe missed with his first shot whereupon the beast charged the elephants on our left. There was a regular mix up, elephants trumpeting, squealing and going in every direction. I did not dare fire but Metcalfe took what looked like a pretty dangerous second shot, apparently without result. By then all the elephants had cleared off and seeing a gap the tigress went straight through. I turned round in my howdah and got a broadside shot just as she was disappearing, and thought I hit but couldn't be absolutely certain. However they swung the elephant round and made a big ring round the place she was going to. They beat about in the middle for sometime without anything happening. I thought she had probably slipped right through, as had she been wounded, they would have known it properly. However they suddenly discovered her quite dead having burrowed right under some grass so as to be practically invisible. Metcalfe and I were lucky in getting both beasts from the same elephant. My shot had gone right through about 6″ behind the shoulder."

All the shooting was finished by 6 p.m. and the evening was spent in saying good-bye. H. H. The Maharaja and his sons went down to Bikna Thori station to see the Royal Party off and the Royal Train steamed out of Bikna Thori station at 6-30 p.m.

Thus ended H. R. H. the Prince of Wales' shoot in the Nepal Terai which certainly for the colossal scale on which it was carried out is to be ranked among the greatest in the annals of big game shooting in this country.

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GAME RECORD OF THE ROYAL SHOOT IN NEPAL.

December 14th to 21st December 1921.

Date.	Place where shot.	Total length.	Girth of body.	Height at shoulder.	Sex.	Shot by	Remarks.
				TIGER.			
14th Dec. ..	Sarasoti Khola ..	9′ 3″	51″	3′ 2″	Male ..	.. H. R. H. The Prince of Wales.	The tiger was hit twice by H. R. H. and Lord Cromer and eventually killed by Col. Worgan.
,, ,, ..	Gharar	9′ 8″	52″	3′ 2½″	Do. ..	.. Capt. E. D. Metcalfe.	
,, ,, ..	Dhobasher	7′ 9″	44″	3′ 1″	Female	.. Capt. Poynder.	
,, ,, ..	Haria (Dhoba) about 20 miles from camp.	8′ 4″	45½″	3′ 0″	Do. ..	.. Capt. Dudley North.	
15th ,, ..	....	7′ 10″	41″	2′ 10″	Do ..	.. Sir Godfrey Thomas.	
16th ,, ..	Baghai	9′ 7″	50″	3′ 2″	Do. ..	.. Lord Louis Mountbatten.	This tiger had a wound in the forehead caused by one bullet: one hole near the fore-paw.
,, ,, ..	Odar	8′ 9″	46″	3′ 0″	Do. ..	.. Vice-Admiral Sir Lionel Halsey.	
,, ,, ..	Two miles from camp.	8′ 2″	46″	3′ 0″	Female	.. Sir Godfrey Thomas..	Two shots in forearm, one shot in chest passing clean through; one shot above the eyebrow, and one in the back.
17th ,, ..	....	5′ 4″	23″	2′ 2″	Male cub	.. Commander Newport.	One shot on the forearm. The body of the tiger had been buried before I could answer Commander Newport's question as to whether there was a spherical bullet in it.
,, ,, ..	....	4′ 11½″	23″	2′ 2″	Cub ..	.. Col. Worgan ..	One shot on breast.
,, ,, ..	15th milestone ..	9′ 2″	49″	3′ 1″	Male ..	.. Hon. Bruce Ogilvy ..	1 wound on shoulder. 1 ,, on forearm. 1 ,, on hind left shoulder blade. 1 ,, on right buttock. The mark of the tiger's teeth where he had tried to bite a wound could be plainly seen.
19th ,, ..	Orar	7′ 7″	44″	3′ 0″	Female	.. Hon. Piers Legh.	
,, ,, ..	Tharar..	9′ 10″	51″	3′ 2″	Male ..	.. Earl of Cromer ..	Largest tiger obtained during the shoots.
,, ,, ..	Orar	7′ 10″	44″	2′ 10″	Female	.. Capt. Villiers ..	There was some doubt about this tigress. One impression was that either Captain Legh with his second shot, or Captain Dudley North with his first shot hit it, and Captain Villiers hit it one second afterwards, and it was thought that it was not actually killed with a small bore rifle. It was hit by Villiers with his ·220 rifle. The jaw was partly fractured. This was caused by a small bullet.
,, ,, ..	Do.	4′ 3″	22″	2′ 0″	Cub	.. Hon'ble Piers Legh.	One bullet wound through the shoulders.
21st ,, ..	Two miles beyond Dhoba.	7′ 4″	41″	2′ 11″	Female	.. Sir Godfrey Thomas.	One bullet half way down body.
,, ,, ..	Do. ..	9′ 2″	48″	3′ 0″	Male ..	.. H. A. F. Metcalfe. Esq.	One bullet wound; point of entry just below the left eye.

In addition to the 17 tigers shot a cub was taken alive and was included in the collection of live animals presented to H. R. H. by the Maharaja of Nepal.

Date.	Place where shot.	Shot by	Sex.	Remarks.
		RHINOCEROS.		
		(*No measurements taken in the flesh.*)		
16th	Kasra	Capt. Dudley North	Female.	
17th	Do.	Capt. Poynder	Do.	A calf was taken *in utero*.
19th	Sarasoti Khola	H. R. H. Prince of Wales	Male	The horn was broken.
,, ...	Do.	Commander Newport	Do	
,, ...	Dhoba	Percival Landon, Esq.	Do.	Single ·365 bullet through temple between jaw and the eye.
20th	Do.	Lord Louis Mountbatten	....	One hole through right ear, one hole near left eye and one hole on the left side of the neck.
,, ...	15th milestone	Hon'ble Bruce Ogilvy	Female.	
,, ...	Do.	Lord Cromer	Do.	

Two rhinos wounded by H. R. H. and Capt. Dudley North respectively were subsequently picked up dead by the Nepalese after the shoots were over. The hides were found to be too decomposed to be of use.

			Length.	
		LEOPARDS.		
19th	Ghangar	Lord Cromer	6′ 2″	
20th	23rd milestone	Sir G. DeMontmorency	6′ 7″	
		BEARS.		
19th	Thangar	.....	5′ 0″	There was much controversy about this and in my opinion it was Col. Molesworth's and not Capt. Armstrong's as was at first thought. 21 shots were fired at this Bear. The skin is in possession of Col. Molesworth.
20th	Biknathori Royal Camp.	Capt. Poynder	4′ 11½″	This was bagged just outside the Camp.
		Small Game.		
		On December 17th.		
		7 Jungle Fowls, 2 Partridges, 15 Snipe, 1 Peacock were shot.		

	Totals.
Tigers	17
Rhino	9
Leopards	2
Bears	2
Hamadryad	1

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NOTES ON NEPAL SHOOTING.

RHINOCEROS (*R. unicornis*).

Throughout the shoots I never had the opportunity of measuring any of the animals in the flesh* as they were generally shot far away from camp, and were disarticulated on the spot and sent into the skinning camp in sections, this being the easiest method of transporting these big beasts. I am indebted to General Kaiser Shumsher Jung for the following note on the Rhinoceros in Nepal. General Kaiser gives the following measurement of a rhino which appeared to him as 'unusually' big :—

Height at shoulder	6′-4″
Length from nose to root of tail	10′-7″ (measured between pegs)
Tail	2′-1″
Neck	7′-6″
Girth behind shoulder	11′-1″
Maximum girth	12′-6″
Horn	15½″

A female shot by Col. O'Connor during the 'Xmas camp, after the Prince had left Nepal, taped 5′-9″ in height at withers, greatest girth 12′. The longest rhino horn obtained in Nepal, was one of an animal shot by Lord Curzon, then Viceroy in 1901, at Morang. The horn measured 21½ inches with a circumference of 24¾ inches at the base. The record horn measures 24″ and was got by Mr. Briscoe in Assam.

Hodgson gives the following measurement of a new born rhino length 3′-4″ and height 2′. An animal 8 years old taped 9′-3″ in length and 4′-10″ in height, the maximum girth being 10′-5″. A fully developed calf in *utero* taken from an animal shot during the Prince's shikar in Nepal measured as follows :—

Length between pegs	4′-1″
Head and body	3′-4″
Girth	2′-9″
Weight	120 lbs.

Commenting on the habits of the animal General Kaiser writes, "Though it prefers swamps and high grass the great Indian Rhinoceros is also found in wooded jungles, up ravines and low hills; along the numerous rivers it has its particular places for the evacuation of excreta. Along the runs to such places it walks backwards and falls an unsuspecting victim to poachers." The period of gestation is given by Hodgson as 17-18 months though General Kaiser says it is believed to be one year, and the cow produces one at birth. According to General Kaiser breeding takes place at all times of the year. Writers have commented on the longevity of the Rhinoceros, a hundred years being given as the age. General Kaiser is of opinion that as regards breeding and longevity the 'rhino' is 'first cousin to the elephant.'"

Rhinoceros are still very numerous in the Nepal Terai, especially so in Chitawan and along the Rapti river. In January 1907, 28 rhinos were bagged, 14 males and 14 females, yet the forests in Chitawan were in 1909 so full of them that no appreciable diminution in the stock had been made.

Many legends and beliefs are attached to the Rhinoceros in Nepal. Mr. Landon's eloquent account of the scene at the death of one of these animals during the shoot in Nepal is sufficiently illustrative of the esteem the animal is held in by the Nepalese in general. Commenting on the above General Kaiser writes :—

"The flesh and blood of the rhino is considered pure and highly acceptable to the *Manes*, to whom the high caste Hindus and most Gurkhas offer libation of its blood after entering its disembowelled body. On ordinary *Sradh* days

* With the exception of the Rhino calf in *utero*.

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the libation of water and milk is poured from a cup carved from its horn. The urine is considered antiseptic: it is hung in a vessel at the principal door as a charm against ghosts, evil spirits and diseases." The above beliefs are in no-wise confined to Nepal as the Chinese, Burmese and Siamese preserve practically every part of the rhinoceros. The horn, hoof, blood, urine, hide and even the intestines being dried up and afterwards converted into various medicines.

As regards shooting rhino in Nepal the importance of a vital shot has been already commented upon. Selous in his 'Hunters Wanderings in Africa' in writing about rhino says :—"As with elephants it is very unsatisfactory work following up a wounded rhino as they do not go and lie down but walk on and on till their strength gives way. They die very quickly when shot through both lungs and the upper part of the heart, but if shot from the front, and the bullet only penetrates one lung, they will go on to all eternity though throwing blood out of their mouth and nostrils by the gallon. With a broken shoulder they will run first at a gallop and then at a halting trot for more than a mile, but if the hind leg is broken they do not appear to be able to budge a step."

Conditions in Nepal are entirely different from the country in which Selous shot; owing to the nature of the terrain the tracking of wounded rhino is practically impossible and many a mortally wounded beast has been lost in consequence.

A shot through the brain placed a few inches in front of the root of the ear would seem to be the most effective, or a shot through the forepart of the neck severing the cervical vertebrae. In the Society's journal Mr. G. C. Shortridge records shooting an Asiatic two-horned rhino with *a shot gun loaded with lethal* bullet dropping him at 7 paces with a lucky shot in the head which sma shed through the skull and lodged in the brain.

Writing of the Rhinoceros of Somali Land (*R. bicornis*) Captain P. Z. Cox (Society's Journal, Vol. XIII, p. 93 *et seq.*) describes his experiences and those of Donaldson-Smith, as to the effect of variously placed shots with heavy rifles, the conclusion arrived at being that the "knock out" blow is a broadside shot in the belly, the reason probably being that in this part of the Rhino's anatomy, there is such a number of nerves and blood vessels that a bullet planted therein causes him a violent shock to the system.

Another writer commenting on the above on page 538 of Vol. XIII takes exception to the belly shot, states he has no faith in head shots, and considers a shot behind the shoulder to be the most fatal.

Tiger (*F. tigris*).

The method of 'ringing' tiger with elephants is I think peculiar to Nepal and certain parts of Assam and is necessitated by the dense jungle, found in the foot hills or Terai. This must be seen to be appreciated. Dense elephant grass up to 20′ in height and so thick as to almost obscure the elephant from the view of the howdah occupant in its passage through it. The training of the actual elephants that beat the inside of the ring is astonishing. Time after time they beat through this dense jungle and in more than one instance have been mauled by the tiger. This also speaks volumes for the courage of the mahouts. The method of ringing was very interesting and exceedingly skilful. Two lines in a V advanced through the jungle where the 'kill' was known to have been dragged to, one line beating up towards the other. As soon as the tiger was flushed the open ends of the V closed in an incredibly short time, and in only two cases failed to enclose the game.*

The vitality of one tigress calls for comment; she and two cubs were ringed on, I think, the fourth day and was still alive and dangerous with 2 bullets through the head, one in the neck, one in the chest, two in the shoulders and one in the body.

* For further notes on Tiger Ringing in Nepal, *vide* Field of April 22nd and May 6th, 1922.

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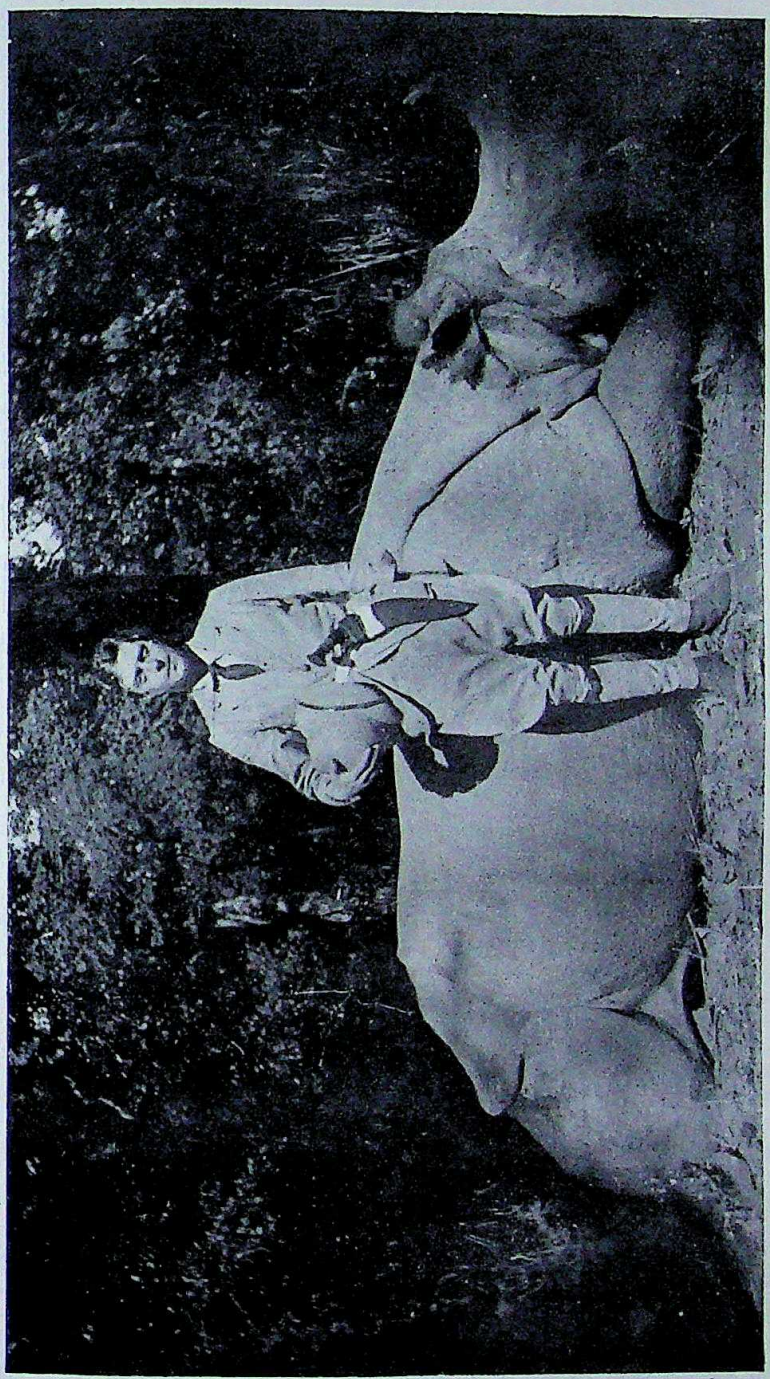

H. R. H. The Prince of Wales with his Rhinoceros.
H. R. H. is seen wearing his Nepal Kukri.

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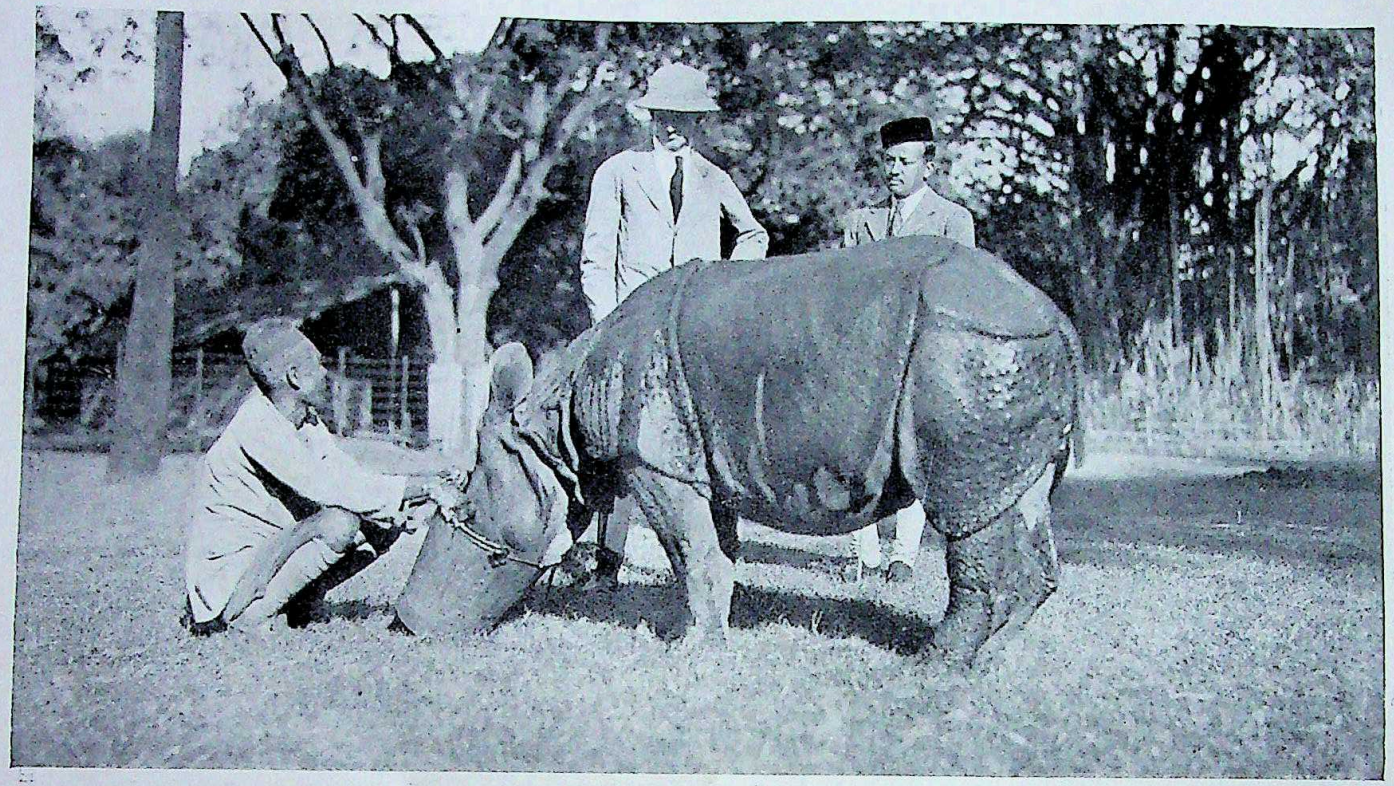

A Young Great Indian Rhinoceros (*R. unicornis*).

One of a collection of animals and birds presented by H. H. the Maharaja of Nepal to H. R. H. the Prince of Wales. The animal was photographed at the Victoria Gardens, Bombay, where the collection was housed prior to its despatch to England.

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ELEPHANTS (*E. maximus*).

The visitor to Nepal is struck with the numbers of elephants met with. The total roll-call of elephants used in connection with the Royal shoots was 423, which were divided into three sections according to the district, *viz.*, those assigned to Thore, those to Haraiya and those to Kasra. What the camel is to the desert the elephant is to Nepal—practically the only means of transport through its pathless jungles. In the wild state they are plentiful in the South of Nepal (the Terai). In some years they are more commonly found than in others. During the rains they visit the cultivated portion of the Terai doing a considerable amount of damage to crops, etc. For the greater part of the time they are buried in the dense jungle roaming in herds of 80 to 90 and, with the exception of an occasional 'rogue', doing a great deal of harm to life and property, these elephants unless molested seldom attack. Numbers are annually caught in Nepal and tamed, a young elephant being completely domesticated by the Nepalese in six months though an old elephant will often take a year to thoroughly tame. The pad elephant is perhaps more comfortable as a means of transport than the howdah-carrying beast. The danger of the animal bolting is a contingency which might at any time arise in hunting from an elephant in a heavy forest country, where an occurrence of this nature is fraught with extreme danger to the occupants of a howdah or indeed of a pad. A friend of mine related an exciting experience which befell him while shooting in the Terai. An infuriated rhino took it into his head to charge, and selecting the elephant on which he was seated made a terrific onrush. The elephant immediately turned and bolted for dear life, hotly pursued by the monster. My friend's mount was frantic with fear and went crashing through the jungle. In a moment half the howdah was swept off by the branch of a tree, the great beast not abating the pace one jot went on and on. My friend thought he would be killed and stood an excellent chance of ending his career. The rhino was close behind and would certainly have 'got home' had she not been turned from her purpose by her calf, who stopped abruptly and the mother seeing she was unaccompanied turned and gave up the chase. The elephant swerved to the left fortunately striking an open bit of country, but she did not give up her headlong flight, till she had put a good 2 miles between herself and the scene of the adventure.

COLLECTION OF ANIMALS, BIRDS AND REPTILES PRESENTED BY H. H. THE MAHARAJA OF NEPAL TO H. R. H. THE PRINCE OF WALES ON SUNDAY, DECEMBER 18TH, 1921, AT THE SHOOTING CAMP, BIKNATHORI.

Mammals and Invertebrates.

1 Baby Elephant (*E. maximus*).
1 Rhino Calf (*R. unicornis*).
2 Leopard Cats (*F. bengalensis*).
2 Himalayan Black Bears (*U. himalayanus*).
1 Black Leopard (*F. pardus*).
1 Clouded Leopard (*F. nebulosa*).
1 Tiger (*F. tigris*).
1 Tibetan Fox (*V. ferrilatus*).
1 Mountain Fox (*V. montanus*).
2 Sambhars (*C. unicolor*).
1 Tahr (*H. jemlaicus*).
3 Musk Deer (*M. moschiferus*).
1 One-horned Sheep (*Ovis* sp.).
1 Four-horned Sheep (,,).
1 One-horned Tibetan Shawl Goat (*Ovis* sp.).

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Mammals and Invertebrates—contd.

2 Tibetan mastiffs (*C. domesticus*).
„ „ pups.
1 Monitor (*V. bengalensis*).
1 Python (*P. molurus*).

Birds.

4 Nepal Kalij (*G. leucomelanus*).
1 White Crested Kalij Pheasant (*G. albocristatus*).
4 Monal Pheasants (*L. refulgens*).
4 Cheer Pheasants (*C. wallichi*).
2 Koklass Pheasants (*P. macrolopha*).
4 Chukore Partridges (*C. chukor*).
Swamp Partridges (*F. gularis*).
2 Green Pigeons (*O. phayrei*).
10 Bronze-winged Doves (*C. indica*).
3 Great Indian Adjutants (*L. dubius*).
1 Hawk.
Pea-fowls (*P. cristatus*).

The animals were brought down from Nepal to Bombay under the charge of the writer of this article and Capt. Shanka Bahadur Shah, a cousin of the Maharaja, and some Nepalese assistants and though there was a certain amount of delay they stood the journey very well and arrived in Bombay on January 10th without any casualties.

BAGS* OF SOME OF THE SMALLER SHOOTS BETWEEN NOVEMBER 26TH, 1921, UP TO BUT NOT INCLUDING THE MYSORE SHOOT IN FEBRUARY 1922— TOGETHER WITH SOME FIELD NOTES.

SMALL GAME SHOOTING AT UDAIPUR.

26th November.

First Party. A party consisting of H. R. H. the Prince of Wales, Lord Louis Mountbatten, Col. Harvey, Capt. Dudley North, Commander Newport and Mr. D. Petrie went out to the Pichola Lake and shot 11 Snipe and one Chinkara in two and a half hours. They also shot at Fatch Sagar and got 1 Goose, 15 Snipe and one Chinkara. (The Chinkara were shot by Lord Louis Mountbatten and Capt. Dudley North.)

Second Party consisting of Sir G. de Montmorency, Col. Worgan, and Mr. A. Metcalfe shot at Jaisamand and got 15 Snipe.

A party consisting of Admiral Halsey, Sir G. de Montmorency, Sir Godfrey Thomas, Col. Worgan, Capt. Bruce Ogilvy and Mr. Holland, Agent to the Governor-General in Rajputana, went to Jaisamand. There were two beats for Sambhar and Leopard, but nothing was shot, though some Sambhar were seen.

IMPERIAL SAND GROUSE AND SMALL GAME SHOOTING AT BIKANER.

3rd December.

The whole party motored out from Bikaner to Kodamdesar to shoot demoiselle crane. H. R. H. and staff arrived at Kodamdesar at about 10 o'clock where they found a small artificial tank surrounded by huts with decoy cranes placed around. Having got into their huts, lookout men were

* Most of the Bags were taken from the Royal Game Book now in the possession of the Hon'ble Bruce Ogilvy.

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posted at various points who signalled when they saw flights of crane approaching. They were generally flying too high to start with, so people were told to let them fly round two or three times and let them get lower before shooting at them. In the morning at Kodamdesar the bag was 26 crane and 4 duck.

In the afternoon the party shot duck in Gujner Lake. They got 299 ducks.

Total bag of the day 303 ducks and 26 cranes.

5th December.

H. R. H.'s staff at Gujner shot 5 Duck, 1,061 Imperial Sand Grouse and 324 Common Sand Grouse.

Admiral Halsey shot at Gujner 1 Black Buck and 1 Chinkara.

6th December.

H. R. H. and staff at Gujner shot 2 Duck, 885 Imperial Sand Grouse and 29 Common Sand Grouse.

H. R. H. shot 2 Black Buck and 1 Chinkara.

Lord Louis Mountbatten shot 4 Chinkara.

BLACK BUCK AND DUCK SHOOTING IN BHARATPUR.

7th December.

Lord Louis Mountbatten.	1 Black Buck.*

8th December.

H. R. H and Party.	1 Black Buck. 2,200 Duck. †

In the duck shoot the birds remained more or less low for the first 20 minutes. Some of the butts were nearly 2 miles' walk from the edge of the lake. Consequently although people walked as fast as they could, the bugle for the commencement sounded 10 minutes before they could get to the butts. After this gun cases had to be opened so that some of the best part of the shooting was missed.

ELEPHANT AND SMALL GAME IN BURMA.

4th January.

Commander Newport, Mr. Petrie, Mr. Foster.	at Mandalay	28 Snipe.

4th January.

Admiral Halsey, Mr. Petrie, Commander Newport, Mr. Thompstone.	at Mandalay	119 Snipe.

6th January.

Sir G. deMontmorency. Col. O'Kinealy.		25 Snipe.

7th January.

H. R. H., Col. Harvey, Commander Vibart.	Mandalay	85 Snipe.
Lord Cromer, Lord Louis Mountbatten, Mr. Thompstone.	Mandalay	46 Snipe.

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* One of Lord Louis Mountbatten's Black Buck measured 26½."

† H. R. H. the Prince of Wales accounted for 65 birds.

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Admiral Halsey, Mr. Petrie, Sir G. deMontmorency, Col. Pringle.	68 Snipe.
Commander Newport, Mr. Laidlaw.	29 Snipe.

On January 2nd a party consisting of Capt. Dudley North, Capt. Piers Legh, Sir Godfrey Thomas, Capt. Metcalfe, Capt. Poynder and Capt. Ogilvy left Rangoon for Mandalay *en-route* for Upper Burma. They arrived at Mandalay early on the 3rd, and embarked on a steamer to go up the Irrawady. There were three different places at which to shoot and the party was split up as follows :—

Capt. Metcalfe and Capt. Ogilvy.
Capt. Poynder and Sir Godfrey Thomas.
Capt. Dudley North and Capt. Piers Legh.

The elephant shooting party returned on the 8th, spending that night in Mandalay and reached Rangoon on the morning of the 10th.

Bag.

Capt. the Hon'ble Piers Legh	..	1 Elephant.
Capt. E. D. Metcalfe at Ingadi	..	1 „
Capt. F. S. Poynder	...	1 „
		3 Elephants.*

There were six guns in three parties in the Mogok (Ruby Mines) District. Two guns disembarked at Ingadi and Singu; the remainder at Thabeitkyin, the terminus of the Ruby Mines road. In each case jungle was very thick, teak and bamboo being predominant, with some fine timber and spear grass. Fresh tracks of Tsaine and Bison were found in large quantity, but the density of the undergrowth and the consequent noise prevented close approach. At this time of the year, although there was an immense amount of game in the jungle, it was impossible to get up to it, owing to the leaves on the ground being so dry, and it was impossible to track properly. After a long trek, just as the sun was going down on the 5th of January, Sir Godfrey Thomas flushed a bull Tsaine who gave a bellow and was off. Later, when hot on the bull's track, he saw two herds of Tsaine. Then darkness came on.

Capt. Ogilvy had a shot at a Bison, but again in such dense jungle that a certain sight could not be obtained. Capt. Legh got a fine tusker elephant (solitary) and his trackers flushed two large bull bisons. They were within a 100 yards of him when he was inspecting a kill.

On the 7th of January Capt. Poynder got a medium size Tusker (solitary), and killed him with one shot between the eye and the ear.

Sir Godfrey Thomas who started at 5-30 a.m. had a very hard day. He came across fairly fresh tracks and some quite fresh Sambhar blood. It was a sambhar that had been chased and attacked by wild dogs.

Capt. Metcalfe got a small tusker out of a herd and he took a dozen rounds to finally kill it. Large numbers of barking deer were very common and were often seen. Tracks of many sambhar were also found, and the jungle was full of monkeys—mostly Gibbons.

Writing about these shoots Mr. V. H. T. Fields Clarke says—

"Capt. Ogilvy and I had 4 fairly strenuous days. The first day we went out after bison, but did not come across any sufficiently fresh tracks. The

*Capt. the Hon'ble Piers Legh's Elephant tusks weighed 20 lbs. and 21 lbs. respectively. Their length from root to tip along the curve was 3'-6" and 3'-5" respectively. I did not have the opportunity of examining Capt. Metcalf's or Capt. Poynder's Elephant tusks.

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second day we went out after Saing, but could not find the herd. The jungle was very dry and bad for shooting generally. On the third day news of the fresh tracks having been brought in the day before—we followed the tracks of a solitary bison till about 3 p. m. when we came on the animal in dense young flowered bamboo jungle. Capt. Ogilvy got a shot, but where he hit we could never decide—anyhow it was not in a vital spot. The next day we followed up the animal again and although we were close behind it, it knew it was being followed and kept ahead of us. This day we left camp at 5 a.m. and did not get into Singu till 11 p.m. and must have done all told the best part of 30 miles."

The party covered more than 65 miles in three days ; mostly climbing, too, through very fine jungle. The hills there went up to 3,900 feet.

SNIPE SHOOTING AT MADRAS.

14th January	by a party of members of the staff ..	65 Snipe.
17th January	„ „ „ „ „ ..	44 „
21st January	„ „ „ „ „ ..	21 „
	Total bag ..	65 couple.

This was very interesting shooting because the snipe were mostly in bushes. There was no water and the shooting was mostly overhead.

BLACK BUCK SHOOTING IN INDORE.

2nd February.	
Capt. Dudley North, Capt. the Hon'ble Piers Legh and Capt. Ogilvy	1 Black Buck.
3rd February.	
Capt. Dudley North, Capt. Piers Legh, Sir Godfrey Thomas and Commander Newport	2 Black Buck.
Total bag ..	3 Black Buck.

The shoot on February 2nd was an ordinary stalk on a flatish plain. There were a great many buck, but at first no one could get near any of them. A pack donkey was conscripted and then Capt. Dudley North shot a buck.

On February 3rd the party motored out from Indore about 8 miles where they found bullock carts. Sir Godfrey Thomas got his buck after going about three quarters of an hour. There were a lot of herds about. Commander Newport also got a buck. The name of the district where shooting took place on both occasions was Bijasani (one of the State preserves).

RIFLES AND GUNS USED BY H. R. H. THE PRINCE OF WALES AND SOME MEMBERS OF H. R. H.'S STAFF DURING THE SHOOTS IN INDIA.

RIFLES—H. R. H. THE PRINCE OF WALES, K.G., M.C.

1. One ·400 bore express double barrel rifle No. 21906 by J. Purdey and Sons, London. Barrels made of Sir Joseph Whitworth's fluid pressed steel, taking 47 grains low pressure Cordite and 230 grains bullet

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2. One ·400 bore express double barrel rifle by J. Purdey and Sons, London, taking 3″ case, 47 grains low pressure Cordite and 230 grains nickel base bullet.
3.* One ·280 bore single barrel high velocity magazine rifle by Chas. Lancaster, No. 13097, taking 52 grains powder and 160 grains hollow bullet.
4. One ·450 bore rifle supplied by H. H. the Maharaja of Udaipur.
5. One ·470 bore rifle supplied by H. H. the Maharaja of Udaipur.

SIR GODFREY THOMAS, C.V.O.

1. One ·450 bore rifle by George Gibbs.
2. One ·280 bore Ross single barrel magazine rifle. Property of Lt.-Col. R. D. Waterhouse, C.B., C.M.G., Buckingham Palace.

CAPT. DUDLEY NORTH, C.M.G., C.V.O., R.N.

1. One ·470 bore double barrel rifle by Gibbs. (Shot tiger and rhino in Nepal with this). This rifle was used by H.R.H. when he shot his Rhino.
2. One ·286 bore Mauser magazine rifle for Chinkara, etc. (Probably this is a mistake and ought to read ·256 bore Mannlicker Schonauer.)

CAPT. F. S. POYNDER, M.V.O., M.C.

1. One ·470 bore double barrel high velocity rifle by Chas. Boswell, charge 75 grains Axite and 500 grains bullet.
   This was a first class all round weapon which could not be bettered.
2. One ·350 bore single barrel automatic rifle by Remington Arms Co. firing 200 grains bullet. Little used on this tour, but an efficient light rifle. Not recommended for normal all round use owing to delicate mechanism being likely to jam under unfavourable conditions of sand, etc.

Capt. Poynder could not speak too highly of No. 1. He shot a tiger and an elephant each with one shot killing them instantly. It is very powerful. not too heavy to be portable and hits like a sledge hammer.

CAPT. E. D. METCALFE, M.C.

1. One ·450 bore express rifle.

LORD LOUIS MOUNTBATTEN, M.V.O., R.N.

1. One ·450-400 bore double barrel high velocity rifle by Watson Bros. For Tiger and Rhino.
2. One ·375 bore rifle by Watson Bros. for Buck and Gazelle.

H. R. H. THE PRINCE OF WALES.

GUNS.

1. Two 16 bore double barrel guns by J. Purdey & Sons, London. (Made of Sir Joseph Whitworth's fluid pressed steel).

CAPT. F. S. POYNDER.

1. One 12 bore double barrel hammerless gun by Francis Scott, Birmingham.

---

* H. M. the King in 1911 used the same type of rifle in Nepal.

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I am very much indebted to different members of H. R. H. the Prince of Wales' staff whose names appear in my notes and to all who took part in the shoots for the help and encouragement they have given me in compiling these records, especially to Sir Geoffrey de Montmorency, who most kindly read through the final proofs for me. The authorities in Nepal, in particular General Kaiser Shumsher Jung Bahadur and Col. O'Connor, also helped me very much, and it is through the kindness of Col. Samar Shumsher, a nephew of the Maharaja, that some of the photos are published. But most of all I am grateful to Col. Burton, a big game hunter of great experience with whom readers of the Journal are familiar for his valuable advice and criticism, and my colleague Mr. Prater, who with his ever ready good nature, and his great experience, gave me most valuable assistance both as regards the editing and final arrangement, and the selection of material from a mass of rough field notes. I regret that exigencies of space, and the not-to-be-forgotten question of expense, has prevented me from publishing a large number of illustrations of the Nepal shoot (and other shoots mentioned in the narrative), from the photographic records in my possession.

In a future number of the Journal will appear a report drawn up by Messrs. Hinton and T. B. Fry of the British Museum regarding recent Natural History collecting in Nepal. This collecting work was conducted by Lt.-Col. R. L. Kennion with the assistance of the Society's collector N. A. Baptista, and the report deals with the physical configuration of Nepal, so that in this article I have not dealt further in the matter of describing the country.

BOMBAY NATURAL HISTORY SOCIETY,
12*th June* 1922.

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NOTES ON NEW AND RARE INDIAN DRAGONFLIES.

By

Maj. F. C. Fraser, I.M.S.

(*With 2 Text Figures.*)

1. Hemicordulia asiatica, Selys.

Up to the year 1918 this rare dragonfly was only known from 2 males both of which had been taken in Assam. In the year mentioned whilst going over a collection of specimens sent from the Agriculture Institute, Pusa, I found a pair of these insects which had been taken some time before by Mr. Bainbrigge Fletcher at Shillong and had remained in the Pusa collection for some time unidentified.

Mr. Fletcher on his next visit to Shillong took a number of specimens both male and female on the Ward Lake and has sent me others since.

It was thought that the insect was localised to the N. W. until this year when I received a letter from Mr. Bainbrigge Fletcher who was staying in Kodaikanal stating that he had seen a Corduline on the lake there which much resembled *Hemicordulia asiatica*. He finally secured specimens both by the net and others which he found caught up in spider webs on sedges, on the borders of the lake and on receipt I found them to be true *H. asiatica*.

Mr. Bainbrigge Fletcher in his covering letter, when sending these specimens suggested that the insect would probably be found in the Nilgiris and in this he proved to be a true prophet. Two days after receiving his letter I had occasion to go down to Coonoor and there in a shady lane adjoining Sims Park took my first *H. asiatica*, a male, which was hawking insects up and down the road.

The same day on returning to Ooty I ran down to the lake and immediately saw a male and shortly afterwards several more, hawking along the banks. The insect is fairly common on the Lovedale lake as well as the Ooty lake from August to the 1st November, exuvia being common in September and larvæ not difficult to obtain amongst the grass and sedges lining both lakes.

I hope to obtain information of this insect from the lake in Newara-Eliya, Ceylon, next season and probably also from the lake at Mahableshwar. From the numbers seen it would appear that the insect is more common in the south than the far north.

2. Aciagrion paludensis, sp. nov.

2 males and one female at Masnagudi, Nilgiris, 4,500′; 2 males Avalanche, Nilgiris, 6,500′, Nov.-Dec. 1921.

Male. Abdomen 24 mm. Hindwing 15 mm.

Head. Face, cheeks epistome and lips pale blue with a fine, basal, black line to the labrum and a broad transverse band across the epistome, also black; eyes pale blue except for a broad, black cap on the upper pole; occiput and vertex black, the former with a transverse, oval postocular spot of pale blue on either side connected across the middle line by a narrow band of the same colour.

Prothorax, with a fine pale blue colour anteriorly, the posterior border finely pale yellow and the sides broadly pale blue.

Thorax black on the dorsum marked with narrow, pale yellow, humeral bands; the sides blue marked only by two small, black, linear spots posteriorly; tergum spotted with blue.

Legs white, the extensor surface of femora striped with black.

Wings hyaline, stigma small, equal in all four wings, sepia; postnodal nervures 9 in the forewing, 8 in the hind.

Abdomen pale blue marked with black as follows:—segment 1 with an obdurate, dorsal, black spot separated by a narrow, blue, apical annule from a

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dorsal, black, thistle-shaped mark on segment 2. The latter mark connected by a short, narrow stalk to a narrow, black annule at the apex; segments 3 to 7 with broad, dorsal, black stripes connected to apical, black annules and separated from each other by narrow, blue, basal annules; segment 8 all blue save for a dorsal, black mark shaped like a chess pawn with its apex directed basal. In the *Masnagudi* specimens this spot extends as far as the base but in the specimens from Avalanche it falls far short of it; segment 9 entirely blue; 10 with a dorsal, broad, X-like mark of black.

Anal superior appendages very small, foliate, triangular, strongly divaricate, black tipped with white; inferior appendages small, conical and white.

Female. Abdomen 23 mm. Hindwing 15.5 mm.

Almost exactly similar to the male and differing only by the stouter abdomen, by the 8th segment having an uniformly, broad, black, dorsal stripe, segment 9, a large, basal, triangular, black spot and the 10th all blue. The anal border of the latter is strongly indented and raised into a prominent hump on the dorsum not however cleft on top as in the *Ischnura*. The spine on the ventral, apical aspect of segment 8 is white and very robust.

Hab. The *Masnagudi* specimens were found among sedges along the borders of the drinking water tank, whilst those from the plateau above were found in marshes. They are very conspicuous although so small, by reason of their bright blue colour and can be easily picked out from the more sombre coloured *Aciagrion hisopa* with which they mix. They are smaller and more slender than any of the other species of the genus.

I have seen a pair collected by Mr. Bainbrigge Fletcher at Simla, 23-5-1918, 7,000′, which apparently belongs to this species or is a local race. They differ only in having 8 instead of 9 postnodal nervures in the forewing, and the marking on the 8th segment which in the male is a plain wedge of black tapering from the apex of the segment to its base and unidented on its sides.

From *hisopa* and *tillyardi* the species may be distinguished by the fewer postnodal nervures and also by the 8th abdominal segment bearing a black marking (immaculate in the two species mentioned).

3. Anaciæschna donaldi, sp. nov.

As the description of this new species is shortly appearing in "Indian Dragonflies", I refrain from here giving it in detail. Shortly it may be described as an *Anaciæschna* of the size and bulk of *Anax immaculifrons*, with the wings deeply and uniformly enfumed from base to apices and with the general colouring of the body, dark warm brown marked with brilliant apple green. It is one of the largest and finest of the Indian dragonflies so far discovered.

Mr. Bainbrigge Fletcher sent me a painting made by his wife of this insect from Kodaikanal this year and from it I was able to recognise an insect which I had had in my possession since 1908 in which year I had taken it at Kodai. (The note on the packet stated that the insect's colours were dark brown and bright apple green, but the colours had so faded that I was unable to make out any such markings, and so was reluctant to publish the species until I had more reliable data). A few days later I took a female of the same insect on the Ooty lake and a week later received another female from Mr. T. Hearsey from Yercaud Between the three of us we secured 6 females and saw probably another 6 (also females). Both Mr. Hearsey and Mr. Fletcher believe they have seen the males flying swiftly near the lakes, but I have not been as fortunate and up to date the whereabouts of the male and its appearance remain a complete mystery. I have recently found the larvæ of this insect in considerable numbers in the Lovedale lake, Ooty, and both Mr. Bainbrigge Fletcher and myself have found a number of exuvia. The venation on the wing covers of these latter has been very distinct and very easy to decipher. Quite a number of the exuvia and larvæ obtained are males so their scarcity is hard to explain. Adjacent jungles have been searched in vain and the ponds have been visited at dusk in the hope that

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the insect might be a night-flyer as is its cousin *A. jaspidea*, but all in vain. During the past week I have found it breeding in marshes at Avalanche, Nilgiris, and such spots are probably its natural habitat as all standing waters in these and the Palni Hills are artificial and of comparatively modern formation. I have now a large number of larvæ and should be able to breed out some males in the next few months thus settling the identity of this puzzling insect.

4. Gynacantha o'doneli, sp. nov.

A single male from Hasimara, Duars, Bengal, collected by Mr. H. V. O'Donel.

Male. Abdomen 41 mm. Hindwing 39 mm. Anal appendages 4 mm. Closely resembles *G. millardi*, Fras., from Poona and Malabar, but differs from it by the 3rd segment being more constricted, by all four wings being uniformly enfumed and by its much smaller size which is equivalent to *G. saltatrix*, Martin. The relative sizes of abdomen and hindwing are however different, being 42-35 in *saltatrix* to 41-39 in *o'doneli*, and the dark T-shaped marking on the upper surface of the frons is absent in the latter.

The thorax is an uniform, olive green, paler below and with no traces of humeral bands.

Legs very pale brown with black spines.

Abdomen olivaceous green and brown marked with darker brown and black, apical rings at and towards the end of the segments. The first 2 segments are largely olivaceous green especially on the sides. The oreillets are large and robust and bear 5 to 6 robust spines on the posterior border.

Wings (very ragged in this specimen) deeply enfumed; nodal index:— $\frac{13\text{-}22 \mid 18\text{-}13}{16\text{-}14 \mid 15\text{-}15}$; trigones with 5 cells; hypertrigones traversed four times; 4-5 rows of cells between *Rspl.* and *Rs.* 3-4 between *Miv.* and *Mspl.*; membrane absent; anal triangle of 5 cells; stigma dark golden brown, over 3-4 cells braced.

Anal superior appendages long and slender, almost straight on the outer border, a little dilated after the 1st quarter inwardly, fringed with long hairs. black and inwardly directed and meshing with those of the other appendage, Inferior appendage triangular, nearly half the length of the superiors.

5. Amphithemis nigricolor, sp. nov.

One pair from Hasimara, Duars, Bengal, collected by Mr. H. V. O'Donel.

Male. Abdomen 23 mm. Hindwing 23 mm.

Head. Labium, labrum and epistome creamy white; frons and vesicle metallic blue; occiput black. Eyes reddish brown.

Rest of body, thorax, abdomen and legs matt black, except abdominal segments 2 and 3 which are quite white with pruinescence. There is also some slight pruinescence on the tergum.

Wings hyaline; stigma narrow, very dark brown, non-braced, over about 2 cells; extreme bases of wings slightly saffronated; membrane very small, cinereous; 2 rows of cells in the beginning of the discoidal field; trigones entire; subtrigones traversed once as also the hypertrigones; *Mspl.* absent; 1 cubital nervure to the forewings, 3 in the hind; nodal index $\frac{8\text{-}11\text{—}12\text{-}8}{9\text{-}9\text{—}10\text{-}7}$; the base of the hindwing very narrow, bevelled sharply off, no vestige of a loop.

Anal superior appendages resemble those of *A. vacillans* in shape, but the superior are only slightly longer than the inferior.

The abdomen is very slender, cylindrical and of even length throughout.

Female. Abdomen and hindwing 23.5 mm.

Very similar in shape to the male but slightly stouter and without its dainty elegance. The wings are broader, especially the hind where a distinct loop of 7 cells is found.

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The reticulation in the apices of both right wings is aberrant and the right hind stigma is double the length of any of the others. The basal saffronation is deeper and more extensive ; in the right hindwing there is an aberrant cubital nervure situated close up to the trigone in the angle ; nodal index $\frac{7\text{–}12\text{—}12\text{–}7}{6\text{–}9\text{—}11\text{–}5}$; neuration otherwise as in the male.

Head similar to that of the male, but the labrum broadly bordered with black and the metallic of upper frons encroaching on the epistome.

Prothorax yellow with a black band in front ; posterior lobe small and depressed.

Thorax golden yellow changing to golden brown on the dorsum where there is a diffuse, humeral fascia only visible below ; a small, black streak on the upper part of the postero-lateral suture.

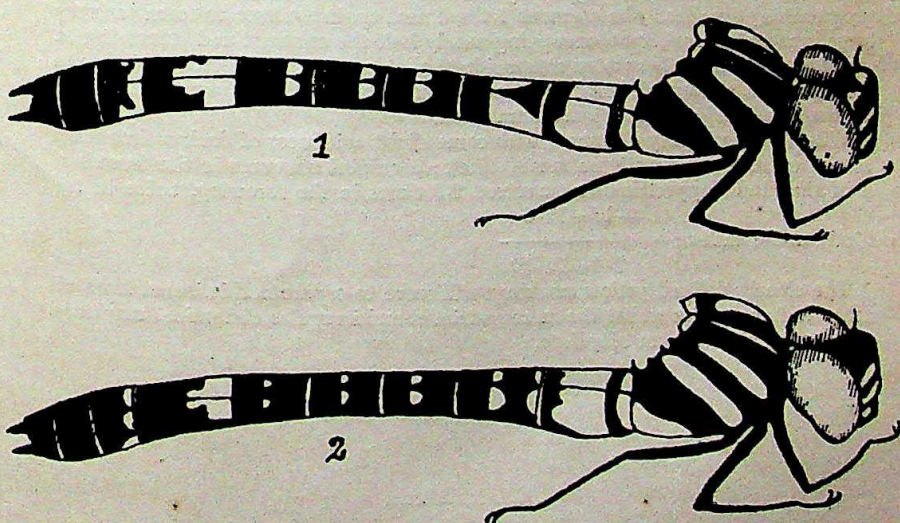
Legs rather long, slim and blackish brown in colour.

Abdomen blackish brown, segments 2, 3 and 4 having broad, light golden yellow, basal, annules, occupying 1-4th, 1-3rd and 1-7th respectively of the basal end of the segments, segments 5 to 7 with a small, basal, subdorsal spot of golden yellow, the rest immaculate.

Genital valves very similar to those of *A. curvistyl* , but the vulvar scale corrugated transversely.

The male is easily distinguished from other forms by its uniform black colour, except *A. vacillans* which in the adult stage is also matt black with abdominal segments 2 and 3 pruinosed white. (Mr. O'Donel informs me that this white mark is very conspicuous and it evidently serves the purpose of a distinguishing sexual mark.) From *vacillans, nigricolor* may be distinguished by the abdomen and hindwing being of the same length in both the sexes and also by its smaller size.

They apparently rest high as Mr. O'Donel informs me that he took the present pair by a swish of his topee whilst riding on the back of an elephant.



1. Semi-lateral view of *Macromia cingulata.*
2. Do. do. of *Macromia flavocolorata.*

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6. Macromia flavocolorata, sp. nov.

A single female from Hasimara, Duars, Bengal, collected by Mr. H. V. O'Donel.

Abdomen 43 mm. Hindwing 38 mm.

Although the male of this insect has not yet been found, the markings of the female are so striking and different from other species of the genus that I have no hesitation in regarding it as new.

It resembles *M. cingulata* by its brilliant clearly defined markings and is evidently allied to that species which has hitherto stood alone in a monotypic group, but there is no possibility of confusing the two.

The facial and abdominal markings differ widely from *cingulata* and the new species is a much larger insect.

Head. Labium with the lateral lobes brown, the base narrowly yellow, mid-lobe yellow, its border and a medial prolongation backwards brown; labrum shiny black with a transverse, bright citron yellow spot at its base; frons and face metallic bluish green with a broad, citron yellow spot traversing the epistome; vesicle and occiput black; eyes bluish green.

Prothorax small, yellowish.

Thorax metallic greenish blue marked with citron yellow as follows:—The antealar sinus and middorsal carina finely moderately broad, antehumeral stripes not quite reaching the alar sinus; laterally a broad, medial stripe and the posterior third of the metepimeron. Beneath white marked with 3 black, triangular spots arranged in a *fleur-de-lys*.

Abdomen tumid at the base, somewhat compressed, dilating again from the 7th segment, glossy jet black marked with clear, well-defined citron yellow marks as follows:—1st segment wholly citron yellow save for a narrow, dark, apical annule; 2nd segment similar but the annule rather broader, narrowing laterally and then sending a prolongation forwards beneath, on the dorsum the yellow invading it slightly; 3rd segment with a basal, subdorsal, linear spot and a medial, smaller, subquadrate, dorsal spot finely separated from its fellow by the black, dorsal crest. These medial spots repeated on segments 4, 5 and 6, but growing progressively smaller. On segment 7 the dorsal spots coalesce to form a very large, quadrate basal, spot occupying nearly half the segment and throwing a small projection analwards on either side of the dorsal crest. Segment 8 has a small, round, subdorsal, basal spot and a quadrate spot low down on the side at the basal end; 9 and 10 are unmarked.

Wings very patchily enfumed, with some slight evidences of dark saffronation at the extreme base; stigma small, black; 5 cubital nervures in the forewing, 4 in the hind; hypertrigones traversed 2-3 times in the forewing, twice in the hind; nodal index:— $\frac{9\text{-}15\text{—}15\text{-}6}{9\text{-}9\text{—}10\text{-}10}$

The clearly defined yellow markings will serve to separate this insect from all other Indian species whilst the more restricted and irregular abdominal markings will distinguish it from *cingulata*.

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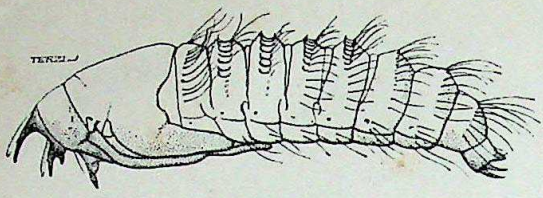

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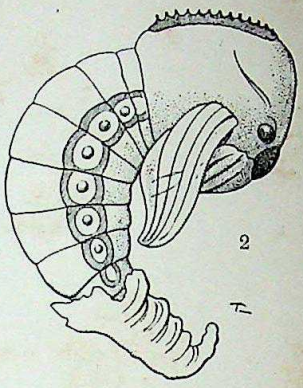

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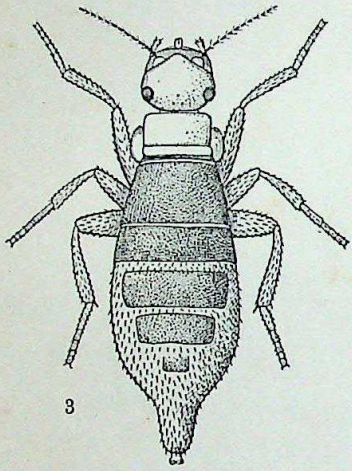

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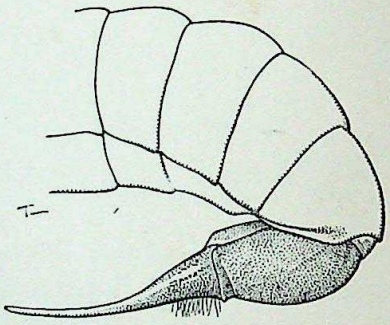

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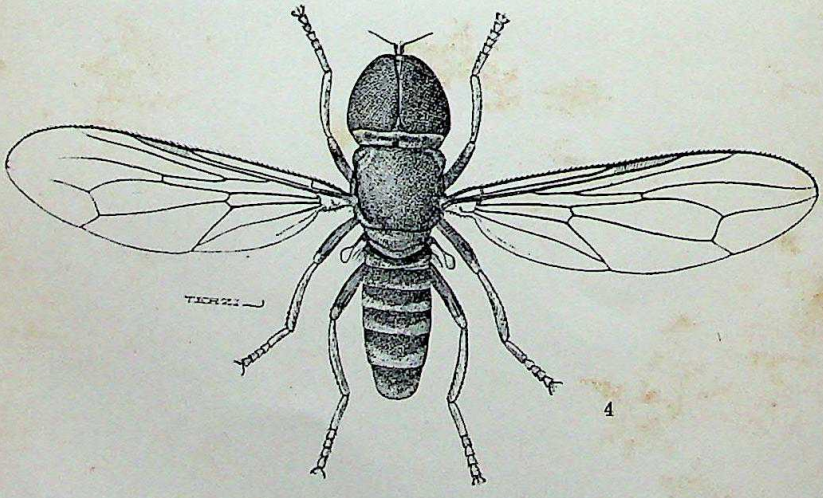

4

INDIAN PARASITIC FLIES.

1.—Pupa of *Bombylius major*, L. x 4.
2.—A Cyrtid pupa (after Brauer).
3.—Wingless Phorid, *Puliciphora* sp. (after Brues). x 38.
4.—*Pipunculus* sp. (Assam-Bhutan frontier). x 10.
4A.—Abdomen of *Pipunculus extensus*, Brunetti ♀. (Occurs in Bengal.) x 23.

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ON INDIAN PARASITIC FLIES.

BY

HAROLD RUSSELL, F.L.S., F.Z.S.

II

With Two Plates

(*Continued from page* 380 *of this Volume.*)

III.

THE MUSCOIDEA.

The next five families that must be mentioned in connection with parasitism and Diptera (*Tachinidæ, Dexiidæ, Muscidæ, Sarcophagidæ* and *Œstridæ*) all belong to the super-family Muscoidea of Townsend. It is very noteworthy that this Muscoidean stock has developed three separate and absolutely distinct types of parasitism, or at least feeding, on mammals. * All three have the same aim, which is to nourish the dipterous larvae at the expense of the Mammalia. What is interesting is that each of the three has attained the same result in such fundamentally opposite ways.

1. In the first group come *Cuterebra* (*Œstridæ*) and its allies. The end is attained by subcutaneous or internal larval endoparasitism. The larva does all the feeding and the imago takes no nourishment whatever. To such a complete extent does this prevail that the adult mouthparts are atrophied and do not function at all. The Oestrid habit of parasitism seems to be the oldest of the three.

2. In the second division we have *Glossina* (*Muscidæ*) the genus which includes the tse-tse flies. The same result is attained by supracutaneous imaginal blood-sucking which strictly speaking is not ectoparasitism. This is the exact antithesis of the preceding. The adult fly does all the feeding by blood-sucking. But it retains and nourishes the larva within the oviduct until full grown. The larva is then extruded and almost immediately becomes a pupa without feeding any more.

3. In the third division we have the case of the Congo floor-maggot (*Auchmeromyia*), another of the *Muscidae*. The fly produces a blood-sucking larva. The desired result is here obtained by supracutaneous larval ectoparasitism. It is a remarkable method because unique among dipterous larvae. The larva sucks blood ex-

* C. H. T. Townsend. "The Taxonomy of the Muscoidean flies 1908) Smithsonian Miscellaneous Collections. Vol. 51.

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ternally by mechanical means. It pierces the skin of sleeping persons with its small sharp jaws and imbibes their blood. The habit is without parallel among Diptera. The larva is a footless maggot with very minute jaws and cannot attach itself to the skin of the host except by the mouth-parts. It cannot cling whilst piercing by any structure except the mouth-hooklets. Such a habit could hardly have arisen but for the fact that the African natives sleep on mats on the earthen floors of their huts. The larvae, which probably originally fed on foul liquids, are common beneath children's mats which become stained with urine. The adult flies are attracted by the smell and lay their eggs under the mats.

It has been stated previously that the parasitic habit of the *Œstridae* is apparently the most ancient. The *Glossina* habit comes next. The habit of blood-sucking of the Congo floor-maggot is evidently a comparatively recent development. The stages of parasitism can thus be placed in order. In the *Hippoboscidae*, which are imaginal parasites and which will be described in the section on Pupipara, the peculiar mode of reproduction of *Glossina* is carried a stage further. In *Glossina* the larva when extruded has sufficient power of movement to find a suitable place for pupating; thereupon its integument becomes chitinized to form the pupal envelope. The Hippoboscid larva upon extrusion at once undergoes this change; the Hipposboscid female therefore deposits the larva in a situation suitable for it to remain during the pupal period.

The *Hippoboscidæ* are probably an offshoot from the old muscid stock. The *Œstridæ* are possibly an earlier off-shoot in an opposite direction from several stems of the same stock. Townsend regards the *Œstridæ* as a polyphyletic group showing affinities with various sub-families and tribes of Muscoidea. Its preponderating characters are due to similar parasitic modes of life in the larvae with corresponding similarity in the adults. These suggestions are enlightening when one tries to discover the origin of the different forms of parasitism among flies.

J. Pantel in his "Recherches sur les Diptères à larves entomobies" has suggested ten groups of Muscoid flies founded on reproductive and parasitic habits.* These may be compared with the five Tachinid groups of Townsend referred to further on and based also on reproductive habits. Townsend considers that Pantel's

* Two parts of this great and interesting contribution have appeared: I. Caratéres parasitiques aux points de vue biologique, ethologique et histologique. La Cellule (1910) Vol 26 pp. 27-216. II. Les enveloppes de l'oeuf avec les formations qui en dépendent; les dégats indirects du parasitisme (1913) Vol 29 pp. 1-289. Each part contains a bibliography of the literature on parasitism in the Diptera. The earlier part of Pantel's two papers has been reviewed and criticised in English by C. H. T. Townsend: "Review of work by Pantel and Poitchimski on reproductive and early stage characters of Muscoid flies." (1911) Proc. Ent. Soc. Washington., Vol 13, p. 151.

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grouping becomes in a large measure a true and natural one though not founded on the ordinary taxonomic characters.

The ten groups are as set out below :

1. Species which glue a short flattened macrotype egg to the host's body.
2. Species which deposit on the food of the host a microtype egg containing the developed maggot and destined to be swallowed.
3. Species extruding large and strong larvae known as ordinary flesh maggots.
4. Species which deposit maggots (naked or in choria) in the path of the host.
5. Species which deposit maggots (naked or in choria) probably in the neighbourhood of the host.
6. Species which deposit maggots (naked or in choria) on the body of the host.
7. Species which introduce into the host's body maggots (naked or in choria) by means of separate instruments of perforation and injection.
8. The same but by means of a combined instrument to perforate and inject.
9. Species destitute of incubating apparatus but provided with a variable chitinous ovipositor for introducing the undeveloped eggs into the host.
10. Species which deposit on the host a pediceled egg in which the maggot is already well developed.

Examples of most of these groups will be met with in the five families now to be dealt with.

Tachinidæ and Dexiidæ. The habits and life histories of these two families are so much alike that they can be treated together. The *Dexiidæ* closely resemble the *Tachinidæ*. Willistone considers that the distinction between the two families is very difficult to make, if it be not actually evanescent. Townsend lumps most of the old *Dexiidæ* with the *Tachinidæ*. Both are smallish to fair-sized hairy flies with strong legs and conspicuously large squamae. The habits of the mature Tachinid flies are much the same in all the members of the group which is a large one. They are found on plants and on leaves or flowers which are the haunts of the hosts which they seek to parasitize. So far as is known all the larvae are parasitic in habit and the parasitism is confined to the larval stages of other insects. The individual female Tachinid is not always particular in the choice of the species of larvae which she parasitizes.

In the Muscoidean flies the integument is furnished with many large bristles called *machrochaetæ*. In the *Tachinidæ* this hairiness is most characteristic and is of some interest in connection with their parasitic habits which involve running about and searching for caterpillars. Osten-Sacken has pointed out that these bristles occur

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almost solely in flies with pedestrian habits and he concludes that the *machrochaetæ* are organs of orientation which fulfil much the same function as a cat's vibrissae or whiskers. If it be the truth that the bristles on the Tachinid and other flies are connected with pedestrian habits, it is worth noticing in confirmation that in another utterly different animal, namely the three-toed Sloth, whose habits are the reverse of pedestrian, facial vibrissae are absent.

There can be little doubt that parasitism in the *Tachinidæ* is fairly recent and not nearly so effective and well evolved as, for instance, in the parasitic Hymenoptera with almost similar habits. Unlike most of the parasitic Hymenoptera, these Dipterous parasites do not usually confine themselves to one particular host. By far the largest number of species are parasitic on lepidopterous larvae. The lives of some 400 species have been more or less studied. About 70 are parasitic on Hymenoptera. Then follow as hosts: Coleoptera; Orthoptera; Hemiptera; and other Diptera in diminishing numbers.

The precise adjustment of perfect parasitism has not yet been attained by these flies and they make two frequent blunders with disastrous results to their offspring. The first consists in laying eggs on a caterpillar which is about to moult; the second, in laying eggs on a caterpillar which has been already parasitized, with the result that some or all of the young Tachinids perish of starvation. This points to the comparatively recent adoption of this mode of life. Yet when all is said the Tachinid flies are a successful family. To secure successful parasitism five forms of reproductive habit have been evolved in the *Tachinidæ*. They are thus summarized by Townsend:—

1. Host-oviposition.
2. Leaf-oviposition.
3. Supracutaneous host-larviposition.
4. Subcutaneous host-larviposition.
5. Leaf-larviposition.

These five forms of reproduction are arranged above in order of probable antiquity. The placing of the egg upon the host is thought to be the most primitive, and the placing of the larva on a leaf, where the host will pass, appears to be the most recent stage. From the commonsense view of the habits of these flies this seems natural; and it is also confirmed by a study of the external characters of the flies.* A few words may be added on each of these five methods of reproduction.

1. *Host-oviposition.* The eggs are laid by the female Tachinid on the caterpillars. The eggs are usually thin shelled and in some

* C. H. T. Townsend (1908) "A record of results from rearings and dissections of Tachinidæ." U. S. Dept. Agriculture. Bureau of Entomology. Tech. Series No. 12 Pt. VI. pp. 95-118.

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species on pedicels. The maggots hatch out and penetrate the caterpillars. In some cases the segments of the parasitic maggot's body are furnished with rows of minute spines directed backwards. These help progression over the caterpillars skin and are aids to penetration also. In the second stage of the maggot's life, having served their purpose, the spines for the most part disappear. A very marvellous adaptation appears in the third or penultimate stage. The penultimate stage of many Tachinid maggots presents this strange peculiarity. During the two first stages the maggot derives no air from the outside. In the third stage it protrudes a pointed posterior end through the skin of the caterpillar. The protruded end becomes highly chitinised from exposure to the air and ends in a pointed tube in the base of which lie the posterior stigmata. Through this protruded tube the maggot obtains air. The fourth and last stage of these maggots is passed living free inside the hosts. The cast skins of the penultimate stage remain fixed in their place protruding through the caterpillar's skin. A few species remain as last-stage maggots within the chitinised cast skin and transform to pupæ inside the caterpillar skin. Most Tachinids pupate outside the host and the exit is fatal to the host.

2. *Leaf-oviposition.* The suggestion that the parasitic maggot could obtain entrance into the host by the egg in which it is enclosed being swallowed by the caterpillar, was received with incredulity when originally put forward. The facts are now well established. The eggs are swallowed by the caterpillars and hatch within their alimentary canal. In such cases the eggs are minute, perhaps not a fiftieth part of the usual size, though the flies laying them may be larger than the average size. The piece of leaf swallowed by the caterpillars may be six or eight times the size of one of those eggs. Where a fly produces minute eggs it is certain that when matured they will be black and highly chitinised. They are intended to stand exposure and swallowing. Probably such eggs when deposited on leaves can retain their vitality for a long while. Probably also they are not laid until the embryo is well developed; the digestive juices and the conditions in the alimentary canal act on the chitin, weaken the shell and release the maggot. It is certain that somehow the egg must hatch within a few hours of being swallowed else it would pass through the gut of the caterpillar and perish. A very small egg cannot have a thick chorion and is therefore provided with a chitinised thin one which withstands atmospheric conditions better than an unchitinised thick one. Some eggs are protected by a reticulated surface which possibly preserves them from injury in the swallowing. Thus the history of the species can be read from the uterine eggs dissected from the female Tachinid.

3. *Supracutaneous host-larviposition.* This brings us to another

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phase of Tachinid parasitism but the leap from reproduction by living larvæ is not so abrupt as it may seem. There are species of *Tachinidæ* in process of transition. Female Tachinids of certain species may deposit eggs almost undeveloped, or at any stage of the development of the embryo, or may even perhaps deposit living maggots. When the larva is deposited on the skin of the caterpillar it is exposed to much the same danger as an egg; it may be accidentally or purposely removed by the caterpillar and if the host moults before the maggot has managed to penetrate this is fatal.

4. *Subcutaneous host-larviposition.* Another step forward is attained if the parasitic maggot can be immediately introduced beneath the host's skin. The females of those Tachinids which have attained this higher grade of efficiency are furnished with a long curved sheath which tapers down to a point and is microscopically fine and sharp. The ovipositor fits into the base of this organ and with this organ the female Tachinid punctures the caterpillar's skin at the moment when the living maggot is being extruded. Until Townsend and his assistants worked at this group (1908) the habit of introducing the living maggot within the skin of the host was never suspected in the *Tachinidæ*.

5. *Leaf-larviposition.* It is unexpected to discover that Tachinid parasitism reaches, apparently, the highest efficiency in those forms which deposit their maggots on leaves to wait the passing by of a chance host. The maggots, in a fashion wonderful to relate, are securely attached to the surface of the leaf at the moment of birth by a membranous cup-shaped case which holds the posterior end of their bodies. The maggot can reach out in all directions and moves constantly on feeling the proximity of a host. When undisturbed it lies at length on the leaf but on being touched it becomes excitedly active seeking to attach itself to the expected host. No sooner does it lay hold of a caterpillar than it is torn from the cup-shaped attachment by the motion of the caterpillar and its own exertions.

It would be thought perhaps that the chances of parasite and host meeting under such conditions were very remote. But this is not the case, for the Tachinid female selects leaves and stems where caterpillars have already crawled and usually deposits a maggot where a silken thread has been left by a caterpillar. Possibly the sense of smell guides the flies in selecting these silken threads. In such a case, where the caterpillar follows the thread back, it is sure to pick up the maggot on the way.

A second advantage is gained by this habit in the greater certainty with which a maggot can become attached to a caterpillar especially if one of a hairy sort. Being placed where the caterpillar will pass *over* it, the maggot can attach itself with greater ease to the under parts where hairs are sparse and short. If the female Tachinid tried to

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deposit it on the back of the caterpillar it would be much less certain of securing an attachment. The alarming size of the fly, the consequent frantic efforts of the caterpillar to shake off the maggot and the hairs which protect the back and sides of the caterpillar with an almost impenetrable thicket, are thus circumvented.

The maggots of this group are protected by a thicker and darker integument than the usual white and thin-skinned forms, since they have to pass a time exposed to the atmosphere.

Tachinids form an enormous group of parasitic flies with wide geographical distribution. Over 300 genera have been established. Classification and nomenclature are in a state of flux. The Indian species have hardly been studied at all and must be very numerous.* Here is a rich and almost virgin field for Indian collectors and observers.

Muscidæ and Sarcophagidæ. Although most of the species in these two allied families are not parasitic at any stage of their existence, others are always or occasionally parasitic as larvæ, and a few are blood-suckers in the adult stage. The frontier which divides these two families is undetermined. The Muscoidea are of extremely recent evolution: in fact their evolution is still going on. In these two families we can see parasites in the making. It has already been pointed out that a promiscuous choice of hosts is evidence, and indeed a necessary result, of the recent origin of the parasitism. No fixed habits comparable with those of the Hymenopterous parasites are to be found in any parasitic Muscoidea except the *Œstridæ*.

Muscidæ. To this family belong the only blood-sucking Cyclorrhapha, other than Diptera pupipara if these latter are to be regarded as one of the cyclorrhaphous sections. The blood-sucking Muscids, which as everyone knows, are well represented in India, belong to the three sub-families following:

(1) *Philæmatomyinæ;* with a single genus and three species all Indian.

(2) *Stomoxydinæ:* with some six genera and many Indian species.

(3) *Glossininæ*: with a single large genus: the African Tse-tse flies.

These three blood-sucking groups contain perhaps some potential or embryo parasites. The pupiparous habit is highly developed in the last of the three; and it is but a step to the *Hippoboscidæ* with a completely parasitic life.

The eggs of the Muscidæ usually hatch in a day but sometimes larvæ

* There is an excellent coloured plate (Plate LXVIII) of some Indian Tachinids, after Van der Wulp's water-colour drawings in H. Maxwell Lefroy's "Indian Insect Life" Calcutta 1909.

F. M. Van der Wulp's "Catalogue of described Diptera from South Asia." The Hague, 1896, mentions under fifty Indian species and is otherwise far from perfect.

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are deposited, the eggs having hatched within the body of the parent fly. In this respect the same conditions prevail as in some *Sarcophagidæ* and some *Tachinidæ*. The typical Muscidæ are house-flies, blue-bottles and blow-flies. In the sub-family *Calliphorinæ* there are several grades of parasitism. All the species are oviparous, so far as we know, and usually the eggs are deposited on dead bodies. The stages towards parasitic habits are as follows :—

(*a*) Some flies will occasionally lay their eggs in sores on the skin of living animals where the larvæ can feed on the juices that surround them. The larvæ of *Calliphora vomitoria* L. a common European and American member of the blue-bottle genus, occasionally cause cutaneous myiasis in man and animals. The allied *C. erythrocephala* Macq. is found in North India and may sometimes have the same habit. *Lucillia serenissima*, Fabr., a greenish medium sized fly common about the meat stalls at bazaars in South India, as a rule deposits its eggs on dead meat. Occasionally it will oviposit on sore places in the skin of sickly cattle. This often happens during outbreaks of foot-and-mouth disease in Madras.

(*b*) The next stage begins where this has become the regular habit as is the case with many species belonging to several genera. *Pycnosoma* is a genus to which belong the Oriental representatives of the genus *Chrysomyia* which in tropical America cause serious myiasis in men and beasts. They are thick-set insects with characteristic red cheeks. *P. flaviceps*, Walk., a well known species in South India, deposits its eggs in the nostrils particularly of human beings and camels. The female flies are attracted by foul breath. The larvæ penetrate within the nasal and frontal sinuses producing ulceration, fever and sometimes death.

(*c*) The latest stage of parasitism is the blood-sucking maggot. The two genera *Auchmeromyia* and *Chœromyia* which have developed this habit are both African. The Congo floor-maggot has already been referred to. The larvæ of *Chœromyia* inhabit the lairs of wart-hogs and aard-varks whose blood they suck.

Sarcophagidæ. The flesh-flies, as they are commonly called, are a family of few genera but there are many species and they are difficult to distinguish. The larvæ sometimes live as parasites in wounds and sores causing dermal myiasis. They have also been discovered in the nasal cavities of man and other mammals. Whether this is one of the regular reproductive habits of definite species is not certainly known. The genus *Sarcophaga* is sometimes and perhaps habitually larviparous. These larvæ have been found living in the stomachs of frogs and under the skin of turtles. The larvæ of several species have been also found in snails, beetles, grass-hoppers and in the larvæ of moths.

These flies are common all over India. They may be recognised

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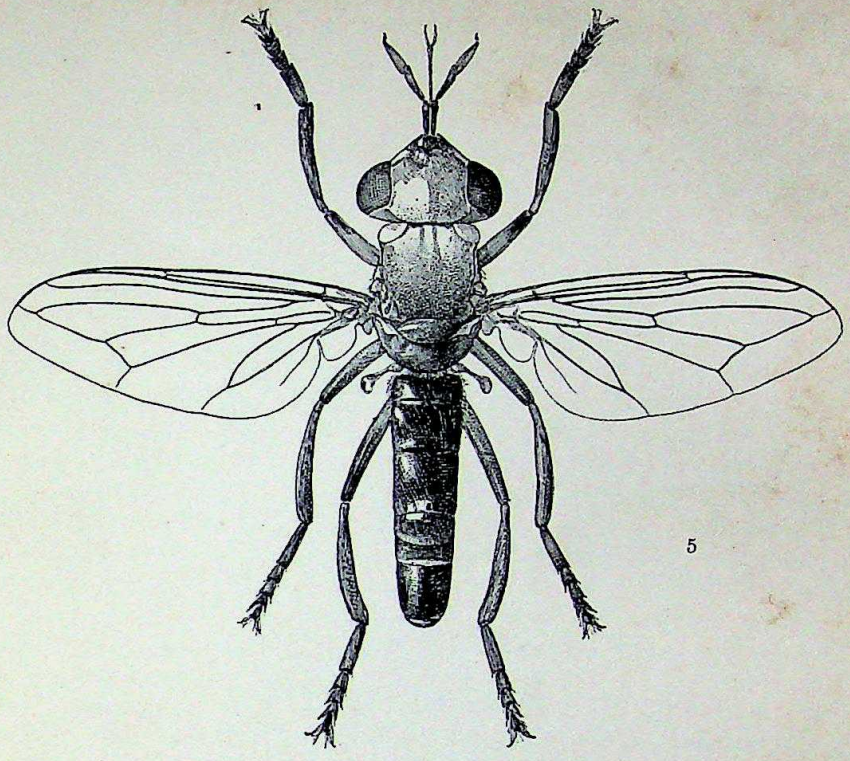

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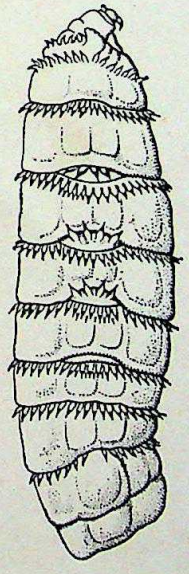

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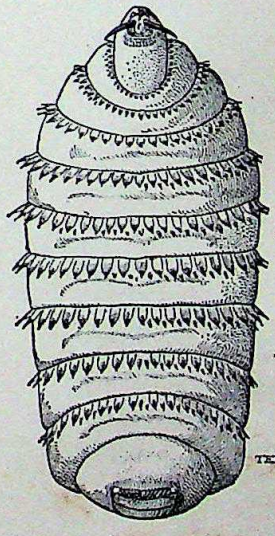

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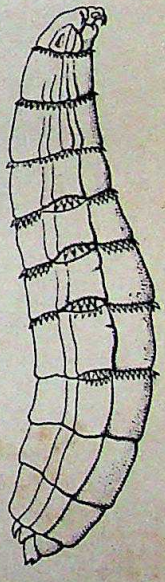

INDIAN PARASITIC FLIES.

5.—*Conops erythrocephala*, Fabr. ♀. x 4.
6.—Larva of *Gyrostigma sumatrensis*, Brauer. (After Bau.) x 2½.
6A.—Larva of *Gastrophilus equi.*, Clark. x 3.
6B.—Larva of *Cobboldia elephantis*, Cobbold. (After Bau.) x 3.

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by their red eyes and grey thorax striped longitudinally with black. They are thick-set flies of moderate size and frequent the neighbourhood of decaying animal and vegetable matter. The known Indian species nearly all belong to the genus *Sarcophaga* and the commonest Indian species is probably *S. lineatocollis* Macq. In Gujarat it is not uncommon to see large sores on the human scalp full of the larvæ of a species of *Sarcophaga ;* whether such larvæ truly deserve the name of parasites depends on how far this method of nutrition is an established and regular habit.

Œstridæ. The flies of this family are sometimes included among Calyptrate Muscoids but are best regarded as a distinct group which has arisen from several Muscoid types and now is much specialised for a parasitic life. They form a small and well defined group with about seventy or eighty described species scattered over the world. The larvæ are always parasitic on mammals and on mammals only. The hosts of the Indian species are horses, sheep, cattle, elephants, rhinoceroses and camels. The note-worthy feature in the life history of an Œstrid fly is that feeding is confined to the larval stage. This is the parasitic period when the growing insect lives surrounded by nourishment.

Parasitism of the larval insects takes three principal forms. We have parasities (1) in the food canal, (2) in tumours formed by the larvæ under the skin, and (3) in the normal cavities of the nose and throat. It is a general rule, with but few exceptions, that each species of Œstrid fly is confined to a single species of mammal; and allied species of fly are parasitic in the same fashion upon allied mammals. The adults are free-living, large, hairy flies, which take no food and exist only for procreation of their species. The adult fly has a minute mouth and often such atrophied vestiges of mouth parts that it is incapable of taking any food. Nevertheless some of these flies live for three or four weeks and display great activity.

Brauer classified the *Œstridæ* according to the combined characters of the larvæ and the perfect insects*. He divided the typical Œstrids into three groups, which coincide with a classification based on the parasitic habits of the larvae. His three divisions are the following :—

1. *Gastricolæ.* Larvae found in the stomach and gut of Equidae (Horses, asses, etc). *Rhinocerotidæ* (rhinoceroses) and *Proboscidea* (elephants). To this group belong *Gastrophilus, Gyrostigma* and *Cobboldia* which are all three Indian genera.

* Professor Friedrich Brauer of Vienna brought out his monograph in 1863. *Monographie der Œstriden*, by Friedrich Brauer. Wien, 1863. It was an epoch-making work and contains a complete bibliography of all the literature on the Œstridæ up to that year. It is still a standard authority in spite of much recent work on the group. See also "*Nachträge zur Monographie der Œstriden*", *Wiener Entom. Zeitung*, (1887) vol. VI., p.4. by F. Brauer.

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2. *Cavicolæ*. Larvæ found in the frontal sinus, nasal cavity and throat of *Covicarnia* (cattle, sheep and other hollow-horned ruminants). *Tylopoda* or camels, *Cervidæ* (the deer family), *Proboscidea* (elephants). The Indian genera are *Œstrus* and *Cephelomyia*.

3. *Cuticolæ*. Larvæ found under the skin of *Cavicornia*, deer, the horse family and rodents. *Hypoderma*, so far as I can discover, is the only recorded Indian genus. This is the group to which the warble-flies belong.

Brauer enumerated sixteen genera in the whole Œstrid family and about half a dozen more have been established since his day. The adult flies belonging to this family are not difficult to recognise. They are fairly large and thick-set flies with big heads, of which the lower part is inflated, giving a sturdy appearance. The short, three-jointed antennæ are sunk in the front of the head and hardly visible. The compound eyes are not prominent, and there are also ocelli, or simple eyes. The abdomen is short, conical and often hairy, somewhat like that of a bee. The veins in the wings are like those of house-flies and others of the Muscid stock, from which the Œstrids are doubtless descended. The second pair of wings (as in all Diptera) are represented by small balancers called halteres. In many Œstrid flies the halteres are protected by scales, usually large, which are known as squamæ or tegulæ.

Much controversy has raged as to the manner in which the larval parasites reach their abiding place in the host's body. It is now generally believed that the eggs, or young larvæ, are, with some possible exceptions, taken into the mouths or nostrils of the animals which they infest, and so proceed, respectively, into the stomach, nose, throat and frontal sinus, or bore a way through the tissues of the body to the skin.

1. *Gastricolæ*.—The genus *Gastrophilus* has many species and a world-wide distribution. All are parasites of horses, wild asses and zebras. These flies are therefore restricted as regards geographical distribution by that of the *Equidæ*. Several species are common wherever men keep horses, and their larvæ are the horse-bots well known to grooms and veterinary surgeons. *Gastrophilus equi* Fab. one of the typical species is widely distributed in India. The female buzzes about horses during the hot hours of the day. Hovering a moment, she deposits a yellowish conical egg which adheres, like the nit of a louse, by its narrow end to the hair. This egg remains securely attached, owing to a viscid matter which is deposited at the same time. The fore legs, which are most accessible to the horse's tongue, are as a rule the parts selected. The flies are somewhat hairy, with fawn-coloured faces and blackish thorax. The abdomen is mottled yellow, with darker brown irregular blotches. The abdomen of the female ends in a long ovipositor, which is doubled beneath

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the body when at rest. Though hundreds of eggs may sometimes be seen glued to the hairs of a single horse, the future host does not seem to be troubled by the performance. Hatching follows after a few days. Perhaps it is the itching caused by the larvæ which makes the horse lick the places. On reaching the alimentary canal, the parasites travel down and ultimately attach themselves by their mouth-hooks to the stomach wall. The place of attachment is marked by a depression, and the head of the larva becomes more and more deeply plunged into the mucous membrane. During this parasitic stage, which lasts ten months to a year and includes two moults and three stages of larval growth, the larvæ feed on the inflammatory products which exude from the minute wound. After the bots are detached from a horse's stomach the pitting remains.

The body of the Œstrid larva consists of twelve segments, of which the first two cannot be differentiated from the cephalic ring. No head can be recognised. The antennæ are rudimentary membranous papillæ. The problem of respiration during the parasitic time in the host's stomach presents difficulties which are, however, successfully solved. On reaching maturity the larvæ let go their hold and pass out of the horse's body with the droppings . The larvæ are then whitish oval maggots, about 20 millimetres long, with rows of brownish spines. They are at first lively, but soon burrow into the horse-dung or the earth, and there turn into rigid, dark-brown shiny pupæ. This stage lasts a month or more. The fly emerges by forcing open the lid of the puparium, and the life-cycle begins once more.

Indian elephants are the hosts of Œstrid larvæ which attach themselves to the stomach walls and go through stages of development similar to those of the horse-bots. The flies belong to the genus *Cobboldia*. The parasites of Asiatic elephants are probably of a different species from those which attach themselves to African elephants. The Indian insect, *Cobboldia elephantis* Cobb., is known, and is a large fly with conspicuous reddish head, black wings and body, marked with startling white spots at the base of each wing. Eggs of flies have often been observed in the erosions at the roots of elephants' tusks. It may be that this is the usual spot chosen by the Œstrids to deposit their eggs. Since elephants do not lick their fore-legs or flanks like horses, a spot near the root of the tusk gives the newly hatched larvæ the best likelihood of making their way into the gut of the proboscidean. The mature larvæ, which have long been known in the stomachs of elephants, are much larger than horse-bots, though of the same type. Their mouths are furnished with only a single pair of strongly curved hooks which act as formidable organs of attachment to the stomach membrane.

The history of our knowledge of this parasite of the elephant is interesting. Cobbold collected the first larvæ from Indian elephants

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which succumbed to an epidemic in Sanger's Circus. Dr. Livingstone, the explorer, subsequently sent home specimens from African elephants. Brauer's own account of how he reared the first known flies from larvæ obtained from the dung of some newly arrived Indian elephants in the Imperial Austrian Menagerie at Schönbrunn is a delightful tale that may be recommended to all dipterologists.*

In this group of Œstrids there remains to be mentioned the genus *Gyrostigma*, which is parasitic on rhinoceroses. The larvæ have been obtained from the stomachs of two species of Asiatic rhinoceros namely *R. sumatrensis* and *R. lasiotis*. They resemble in most characters the *Gastrophili*, or horse-bots, but are larger. Since both species of African rhinoceros are the hosts of allied Œstrid larvæ it would be surprising if the rhinoceroses of the Indian peninsula were exempt from these parasites. Sportsmen who have an opportunity should examine the stomach walls of newly killed rhinoceroses and should detach the larvæ, if they are found, without injuring them. They should be preserved in alcohol.

Elephants, as is well known, are ancient types of mammal which have long existed on the earth. The evolution of mammalian host and insect parasite must have proceeded simultaneously during the long ages of the earth's history. *Cobboldia*, the elephant parasite, is therefore of special interest. The imago is a synthetic type which unites the characters of almost all forms of genuine Œstrid flies. The origin of the elephant is lost in the obscurity of geological ages, whilst the horse and the rhinoceros are both more recently evolved types of mammal and allied to one another. It is also significant, when we appreciate the relationship of the hosts, that the parasites of the horse and the rhinoceros belonging to the Œstrid genera *Gastrophilus* and *Gyrostigma* respectively are closely related. The deduction which may be drawn from these facts is that the parasitism of Œstrid flies on mammals is of ancient origin. Host and parasite have evolved into their present form side by side : and where the mammalian hosts are allied, the parasitic larvæ, which live in their stomachs, will turn into more or less closely related flies.

Cavicolæ. This group comprises some fifteen or twenty species of Œstrid flies, whose common characteristic is that the larvæ live in the cavities within the skulls of a variety of mammals. Sheep, antelopes, goats, buffaloes, camels,deer, horses and the African elephant and hippopotamus are the hosts of these remarkable parasites. In many cases only the larva has been obtained and the adult fly is still unknown. Six or seven species of the genus *Œstrus* are known, but the only recorded Indian species appears to be *Œstrus ovis* L. which has been known to man from ancient times. It is said to be

* "Beiträge zur Kenntniss aussereuropäischer Œstriden", by Dr. F. Brauer (1896) Denks. Akad. Wiss. Wien, vol. 64 p. 259.

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not uncommon in Bengal. The nasal fly, bot or head-maggot of sheep must have attracted the notice of shepherds in all ages. The fly is now found in all four continents and in Australia, the parasite having, thanks to man, travelled round the world with its host, but whether introduced or indigenous to India is uncertain.

The adult is rather a small fly, but larger than a house-fly, and of a yellowish-grey mottled and hairy appearance. Like other Œstrids, it avoids the shade and loves the hot bright sunshine. During inclement weather it hides and emerges in the warmth, to fly with much liveliness at a great height and to bask on stones heated by the sun. According to some observers the approach of the flies alarms the sheep, who huddle together with heads down and bury their noses in the dust. After being touched about the nostrils by the female fly, they snort and rub their noses on the ground According to other observers, the fly has been seen to settle on the nostrils of the sheep, and to deposit as many as fifteen eggs in succession, without causing any immediate annoyance to the future host.

There has been divergence of opinion as to whether eggs or larvæ are deposited, but there is little doubt that in Europe both habits obtain. It has been suggested that this depends on the weather.* The pregnant female, if the weather is fine, deposits eggs round the sheep's nostril. But if low temperature makes her inactive, the ova develop within the body of the parent during the period of delay. Larvæ are then laid in the sheep's nostrils. The larvæ enter the nasal cavities of the sheep, creep into the frontal and maxillary sinuses, even into those of the horn-cores, and there develop. They pass through the usual three stages of an Œstrid larva. In the first stage they are white and transparent, with a length of 2 millimetres. When they have attained maturity they develop dark transverse streaks, and sometimes attain a length of 30 millimetres. The parasites remain about ten months in these cavities of the head, feeding on the mucus. It is not unusual to find three or four together, and at the suitable season they may be found together in all stages of development. Yet they rarely occasion any morbid disturbance in the host unless they are far advanced in development and exceedingly numerous. During the months of larval growth they attach themselves by their mouth-hooks to the membranous lining of the cavity. On attaining maturity, the larva lets go and creeps about until it passes into the nose, from which it is expelled on to the ground by the violent snorting of the host. There pupation takes place within twenty-four hours. The pupal envelope, at first red, becomes brown and ultimately black. In about a month the perfect fly emerges and another life-cycle begins. So far as is known, the life-history of the other members of this group is somewhat similar. Other species of

* "Note on the Deposition of the Eggs and Larvae of *Œstrus ovis*, Linn.", by Walter E. Collinge, *Jour. Econ. Biology*, (1906) vol. I, p. 72.

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Œstrus have been obtained from various wild sheep and from some African antelopes.

An interesting species *Cephalomyia maculata* Wied. is a parasite of camels, and the larval stage is passed in the nose or throat of the host. Both the Bactrian and the one-humped camel suffer from this fly. It is a small species, with thorax mottled yellow and black and abdomen blackish-grey. The head is broad and has a strangely swollen appearance. The wings are small, cut away at the hind margin, and mottled yellow along the anterior border. The halteres are masked by large scales or tegulæ. The larva reaches, when mature, a length of 30 millimetres. It is then sneezed or spat out by the camel. It at once pupates, and, if kept under observation in a box of sand, the fly will be seen to emerge in about fourteen days. This species ranges across North Africa eastwards into India, and is also found in South Europe. It is the only representative of the genus so far discovered. Camels appear to suffer from the presence of the parasite, and during various campaigns in Afghanistan and India the camels in the British expeditionary forces suffered severely. The continuous irritation produced in the nasal cavities and pharynx is followed by snorting and shaking of the head, with much exhaustion and a bloody and offensive discharge from the beast's nostrils. If it should be proved that the same species is also a parasite of such a totally different host as the buffalo (*Bos bubalus*) of Southern Europe and Asia, as has been asserted by some authorities, it would indeed be remarkable. The evidence is not conclusive and it is a general characteristic that Œstrid flies restrict themselves to one host, or, at least, to closely allied species. To find the same form in a camel and an ox would upset many preconceived notions.

3. *Cuticolæ*. Fifteen to twenty species of *Hypoderma* are known, whose larvæ are parasitic on horses, oxen, buffaloes, American bisons, goats, deer, antelopes and musk-deer. The insects are known as warble-flies. Domestic cattle in India are the victims of a Palearctic species *H. bovis*, De Geer, which is nearly allied to *H. lineata*. There is uncertainty as to their exact geographical distribution and whether their life-histories differ to any great extent.* The late Miss Ormerod spent over ten years in collecting the evidence of farmers and hide-merchants as to the injuries to cattle and hides. She estimated that 48 per cent of the hides exported from India were damaged by reason of the holes which the larvæ bore in them. There is little exact information as to the distribution of *H bovis* in India. It seems to be found in Western India from the Punjab southwards probably as far as Gujerat. In Bengal it is confined to the hills. When the female fly approaches the herd of cattle to lay her eggs, the beasts often stampede into the nearest water, where it is supposed the flies

* A good summary of what was known in 1906 was put together by A. D. Imma On the Life-Histories of the Ox Warble Flies," *Jour. Econ. Biology.*, vol. i., p. 74

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do not follow them. This terror is attributed to a shrill buzzing made by the fly. The flies certainly neither bite nor sting the cattel. The female has no instrument, as many parasitic flies have, capable of inserting an egg under the host's skin. Her ovipositor is a flexible tube which opens and shuts in the manner of a telescope.

The flies move with such extreme rapidity that they are difficult to follow with the eye. They are rare in collections. The evidence seems to show that it is through the mouth of the host that the parasites reach the warbles, or subcutaneous tumours, in which they go through the last stages of their larval development. The female is so quick in performing the act of laying that she does not seem to remain on the host for more than a few seconds. The eggs are longish, flattened, white, with an appendage at the base which is perfectly adapted for clasping a hair. A number are often placed on a single hair. The appendage consists of two lobes, which form a bulbous enlargement at the base of the egg, and are attached to it by a thin neck. The lobes close over the hair and give a secure hold as soon as the egg is deposited. The eggs are laid on the backs and flanks of the cattle, perhaps on any spot which the beast's tongue can reach.

Once the eggs are laid, three possible courses have been put forward by different entomologists for the life-history of the parasite between the egg and the warble stage. *First*, that on hatching the larva eats its way through the hide and wanders a short distance in the subcutaneous tissues; eventually it returns to the surface and gives rise to the well-known tumours, in which it lives until the time for pupation arrives. Or, *secondly*, having bored a way through the skin, the larva wanders extensively in the tissues of its host, sometimes reaching the spinal canal and the walls of the œsophagus. Eventually it returns to the surface and completes its development beneath the skin. Or, *thirdly*, that the larvæ never bore through the skin of the host, but are taken into the throat when the beast licks the eggs off its body. Having hatched, the larva slowly bores through the walls of the œsophagus and wanders about the tissues, sometimes reaching the spinal canal through the spaces between the vertebræ. Eventually it reaches the skin as before.

There are grounds for believing that the last is the normal life-history. During the early part of the larval life, growth would seem to be very slow, but the small parasite may wander far and wide through the host's tissues. This is the winter period. Brauer called this stage the *Stillstandstadium*, and pointed out that a similar period of slow growth occurred in other larvæ of the Œstrid family*.

When the eggs are laid, the young larvæ within are already well developed. Sometimes they are licked up with the hair attached and the larva inside, at other times they may have already hatched.

* "Ueber das sogenannte Stillstandstadium in der Entwickelung der Oestriden-Larven," by F. Brauer (1892), *Verhandl. Zool-Bot. Gesellschaft Wien*, vol. 42 p. 79.

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In either event the moisture and warmth of the beast's saliva seem to conduce to their development. It is specially to be noticed that the season of egg-laying coincides with the time when the cattle are shedding their coats and have the habit of licking themselves.

The newly hatched larvæ are worm-like, whitish and transparent; they have minute spines over most of their body, which cause them to adhere to the walls of the œsophagus. In that situation they soon moult and assume the smooth stage. In the smooth condition they bore through the œsophagal walls and wander slowly through the host's tissues. This period of migration lasts some nine months, during which period growth is extremely slow. Towards the end of winter, at least in Europe, they make for a point in the region of the animal's back and there penetrate the skin. A second moult then ensues, and the spiny character is once more assumed. Development is rapid and causes much inflammation. As it reaches maturity the larva grows still more spiny. It lives in the fully developed warble, feeding on the products of the inflammation which it causes and breathing through the hole in the skin. This period of life in the tumour lasts into the ensuing summer. The larva is then some 25 millimetres long, bluntly oval in form, with a warty appearance. Its skin has become thick, and a powerful coat of subcutaneous muscles has been developed. The prickles are larger and more numerous than in the previous stages. They are probably erected by the muscles and used to create irritation and a copious secretion of the pus on which the parasite feeds. During the period of rapid growth it is desirable that the parasite should have access to the external atmosphere and should enjoy a sufficient supply of oxygen. The larva therefore enlarges the hole through the hide and lies with the tail end, containing the spiracles, in the passage, and the head end, hanging downwards, in the cavity of the warble.

When the larva has become full-fed and reaches maturity, it works a way out through the aperture of the warble. In this the prickles on its skin assist, by preventing it from slipping backwards. This exit usually takes place at night, or at least between six in the evening and eight in the morning, a habit that was long ago known to Reaumur. By fixing little bags over the apertures of the warbles it has been ascertained that the larvæ never emerge during the middle of the day. The larva pupates on the ground, taking shelter beneath a stone or clod of earth. The pupa, which is formed in the old larval skin, is dark brown and rather flattened on one side. In about twenty-five days the perfect insect emerges by forcing open the lid at the front end of the puparium.

This account of the Indian Œstrids concludes the group of Cyclorhaphous flies. The next group brings us to the Diptera Pupipara which are imaginal parasites.

(To be continued.)

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RECORDS AND DESCRIPTIONS OF ORTHOPTERA FROM S. W. ASIA

BY

B. P. UVAROV, F.E.S.

(*With* 2 *text figures.*)

Our knowledge of the Orthopteran fauna of the vast deserts of S. W. Asia (Persia, Mesopotamia, Arabia, Baluchistan, Afghanistan, N. W. India) is, so far, extremely fragmentary, this particular group of insects not being usually favoured by collectors. At the same time, each lot of Orthoptera brought home from there, however small and accidently collected it may be, gives the strongest proof of the great richness and originality of that fauna. Endeavouring to collect as full records of species, inhabiting the Asiatic deserts, and of their geographical distribution, as it is possible, I have recently worked out all the odd specimens from Arabia, Baluchistan, Afghanistan, Persia and Syria in the British and Paris Museum collections; a small collection sent by the Bombay Natural History Society, containing the specimens taken by Lt.-Col. J. E. B. Hotson in Baluchistan, Capt. G. C. Shortridge, Lt.-Col. F. P. Connor and Lt.-Col. H. D. Peile in Mesopotamia, and by Mr. Peter Paschen in Persia (the latter lot received by the Society through Colonel P. Gough) has also been identified by me and several new forms described in the present paper. The total number of specimens studied in preparing this paper scarcely exceeds two hundred and the proportion of new species and even genera is simply astonishing. I hope that this fact will encourage all entomologists, who have the opportunity of collecting in those countries to pay more attention to a class of insects usually ignored and regarded as "uninteresting" *viz.*:—Grasshoppers, Katydids, Crickets and other members of the order Orthoptera; the writer will be very pleased to examine and work out all collections of Orthoptera from the Desert regions in Asia, however small and casually made they may be.* The types of new forms, described in this paper, are in the British Museum.

Mantidæ.

1. EREMIAPHILA LÆVIFRONS, sp. n.

♀: Head as broad, as pronotum; facial clypeus distinctly convex, without any trace of upper carina, smooth, sparsely impresso-punctate; ocellar area scarcely concave; transverse furrow delimitating this area from vertex feebly developed; vertex smooth, with lateral furrows distinct, but shallow, while the intermediate furrows are scarcely developed. Pronotum as broad anteriorly as it is long; distinctly narrowed posteriorly; fore margin convex in the middle, bisinuate laterally; lateral margins distinctly convex; hind margin convex; fore and hind angles a little more than 90°, acute; upper surface smooth with a transverse oval gibbosity at the fore margin and two smaller gibbosities posteriorly. Elytra distinctly coriaceous, with raised veins, longer than broad widely rounded anteriorly and at the apex, with hind margin almost straight, slightly excavate beyond the middle. Wings broader than long, with hind angle acute, rounded apically. Fore femora and tibiæ armed with four spines outwardly.

General colouration clay yellow. Head and underside whitish. Elytra beneath with a subapical oblique transverse blue-black band, not reaching the fore margin, and with a not sharply defined dark border; both the band and the

* Collections may be sent directly to the author (British Museum [Natural History] Cromwell Road, London, S.W.7.) or through the Bombay Natural History Society. If any particulars as to the best methods of collecting and preservation are wanted the author will be glad to answer enquiries.

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dark border are well visible on the upside of elytra, as well. Wings unicolorous brownish, with lighter border. Legs whitish beneath and clay-grey, with scarcely perceptible transverse bands on the upper side.

	♀ (type).	♂ (paratype).
Length of body	32,5 mm.	23,5 mm.
Length of pronotum	6, 5	5
Width of ,, anteriorly	6, 5	5, 5
,, ,, posteriorly	5	4
Length of elytra	13, 5	11
Width of elytra	8	7
Length of fore femora	7	6, 5
,, ,, tibiæ	4	3, 5
,, ,, hind femora	14	13

One female and two males, taken at Muscat, Arabia, by the late Lt.-Col. A. S. G. Jayakar (British Museum).

There is only one more known species of this genus, in which the spot on the elytra is visible from above; this is the *E. persica* Wern., which is easily distinguished from the new species by the form of pronotal angles and by the structure of the head, as well as by the far smaller dimensions.

2. TARACHODES ARABICUS, n. sp.

♂. Rather small for the genus. Antennæ about twice as long as head and pronotum together. Head broader than pronotum; facial clypeus transverse, entirely flat, its angles rounded, upper carina feeble and not reaching the sides; occiput with two furrows nearest to the eyes rather well developed, while the two intermediate ones are scarcely perceptible. Pronotum about twice as long as it is broad in its widest part which is before its middle, but distinctly behind the transverse sulcus; sides of pronotum parallel, with a feeble excavation before the dilated part and slightly convergent behind it; marginal expansion narrow in prozona and rather broad in metazona, narrowing gradually towards the base of pronotum; transverse sulcus placed near the base of the apical third, its middle part is very feebly developed, while the lateral parts are deeply impressed and strongly curved forwards, with extreme ends almost parallel to pronotal margins; metazona with an oval gibbosity in its fore part; middle sulcus scarcely perceptible, very shallow near the apex and base of prozona, as well as on the fore part of metazona, being entirely undeveloped on the whole basal half of the latter. Elytra longer than the abdomen, subparallel, with apex lanceolate. Wings distinctly shorter than elytra, with apical lobe markedly separated from the rest by an emargination.

General coloration pale greyish. Facial clypeus with a transverse band, upper and lower margins black. Inner side of fore legs rufous, without any black marks. Prosternum with a black transverse band near its base and brownish near the base of fore legs. Elytra entirely hyalinous, veins greyish, with only a few small brownish stripes along veins. Wings hyalinous, with cells of the hind part very feebly infumated.

	♂ (type).	♀ (paratype).
Length of body	32 mm.	34 mm.
Width of head	5	? (mutilated).
Length of pronotum	7, 5	9
,, metazona	5	6
Width of pronotal dilatation	3, 5	4
Length of fore coxæ	5	6
,, ,, femora	6	6, 5
,, ,, tibiæ	4	5
,, elytra	26	7, 5

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	♀ (type.)	♂ (paratype.)
Length of wings	.. 23	?
,, hind femora	.. 7, 5	7, 5
,, hind tibiæ	.. 7	7

The paratypic female differs from male by the broader pronotum, armed with two tubercules, with margins strongly denticulate; by short elytra and by darker general coloration, with well pronounced grey bands on the legs; inner spines of the fore tibiæ are in female entirely black.

Two males and one female in British Museum from Ktubu, Arabia, G. W. Bury.

This species is easily distinguished from all previously known by the coloration of the inside of fore legs and prosternum; these characters seem to be very constant and quite suitable for separating species in this genus.

The new species is the first Asiatic representative of the genus *Tarachodes*, all others being known from Africa.

3. STATILIA OCELLATA, sp. n.

♀: Closely resembles *St. haani*, Sauss., but differs distinctly by the following characters: pronotum with more elongate prozona; pronotal dilatation narrower; prosternum with two whitish ocellar spots, encircled by black; fore coxæ armed with seven spines; elytra extending well beyond apex of abdomen.

Length of body	50 mm.
,, pronotum	18
,, metazona	13, 5
Maximal width of pronotum	4
Length of fore coxæ	12
,, ,, femora	15
,, ,, tibiæ	4, 5
,, hind femora	17.
,, ,, tibiæ	15, 5
,, elytra	39

One female in British Museum from Quetta, Baluchistan (received in 1889 from the Karachi Museum).

4. FISCHERIA INERMIS, sp. n.

♂: Smaller and more slender than any known species. Antennæ very long, setaceous. Head less than twice as broad as pronotal dilatation; facial clypeus transverse, with apex rotundate; occiput convex with two lateral furrows more deeply impressed than two intermediate ones, which are quite shallow; eyes thick, hemispherical. Pronotum slender; its sides slightly expanded, with a few marginal granules in prozona, but without spines and parallel in prozona and in the middle part of metazona, slightly diverging backwards; fore margin elliptical; coxal dilatation placed just behind transverse sulcus; its width is about one-half as much again as the width of pronotum in its narrowest part, which is about the middle of metazona; metazona twice as long, as prozona; median carina placed in a shallow longitudinal sulcus, very feeble in prozona, scarcely perceptible in the fore third of metazona and entirely disappearing in the hind part of the latter. Elytra extending beyond the apex of abdomen. Wings but a little shorter than elytra. Fore coxæ a little longer than metazona of pronotum, not granulated, armed with 6-7 feeble erected spines along the upper carina; fore femora smooth, their armature, as well as that of fore tibiæ presenting no difference from other species of the genus. Hind metatarsus armed with but scarcely perceptible spinules, closely lying down to metatarsus. Supra anal plate a little longer than its base wide, acutely triangular, with apex rounded, lateral margins feebly but distinctly concave, median keel developed in the middle part only. Cerci rounded, rather thick, distinctly longer than supra anal plate. Subgenital plate with its apex triangularly emarginated between short styli.

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General coloration grey. Fore coxæ unicolorous, fore femora with three darker coloured bands on the upper side. Pronotum unicolorous, darker than elytra. Elytra with a whitish border along the fore margin of the costal area, interrupted by irregular brownish spots; bases of radial veins pale; a somewhat darker not sharply defined transverse spot in the basal third, followed by a whitish area; the second, larger and more defined whitish spot before the apex, followed by a smaller dark spot; veins darker than cellules, and the whole surface appears, therefore, slightly marmorated; anal area brownish-violaceous, but not so dark as in other species, the colour fading backwards. Wings rather equally infumate throughout the whole surface, the basal part being scarcely more hyaline; transverse venules pale; apex with a common, for this genus white spot, encircled by brownish-violaceous colour.

Length of body	40 mm.
Width of head	5
Length of pronotum	9,5
„ metazona	6,5
Maximal width of pronotum	3,25
Minimal „ „	2
Length of fore coxæ	7
„ „ „ femora	9
„ „ „ elytra	30
„ „ „ wings	27
„ „ „ hind femora	13
„ „ „ „ tibiæ	14
„ „ „ „ metatarsi	4,5

The type is unique; it has been taken by G. W. Bury at El-Kubar, S. W. Arabia (British Museum collection).

This new species is easily recognised by its small size, very feebly armed hind metatarsus, not denticulated pronotum and the shape of supraanal plate.

5. FISCHERIA SYRIACA, Sauss.

1871. *Fischeria bœtica*, Ramb. var. *syriaca*, Saussure, Mém. Soc. Phys. Genève, xxi, p. 109.

1915. *Fischeria festæ*, Giglio-Tos., Bull. Soc. Entom. Ital., xlvii, p. 22.

Giglio-Tos, in description of his *F. festæ* gives exactly the same differences of it from *F. bœtica*, as Saussure gives for var. *syriaca*; both being of the same origin, it is obvious that they are identical. The same species (or only subspecies of *bœtica*, Ramb.), and not the typical *bœtica*, Ramb., populates all desert parts of S.W. and Central Asia, and all previous records of *bœtica* from those countries must be undoubtedly credited to *syriaca*.

Male of *syriaca*, of which only female has been described by Saussure and Giglio-Tos, differs well from *bœtica* by its larger dimensions, and especially by longer elytra which extend well beyond the apex of abdomen; wings are scarcely shorter than elytra. Dimensions of a male from Mesopotamia are, as follows :—

Length of body	72mm.
Width of head	7, 5
Length of pronotum	18
„ metazona	12
Maximal width of pronotum	5, 5
Minimal „ „	3
Length of fore coxæ	13
„ „ femora	17, 5
„ hind „	21
„ „ „ tibiæ	25
„ „ „ metatarsus	6, 5
„ elytra	48

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The specimens studied are from the following localities: Kut and Amara in Mesopotamia; Bushire in S. W. Persia; Aleppo, Syria (in British Museum and in Bombay N. H. Society).

6. MICROTHESPIS DMITRIEVI, Wern.

One male in British Museum from Bushire, S. W. Persia. The species has been described (Ann. Mus. Zool. Petersb., xiii, 1908, p. 120) from Djibouti and Harrar on the Somali Coast.

7. IRIS PERSA, sp. n.

♂. Agrees in all essential characters with *I. oratoria*, L., but differs well from it in the shape of head, pronotum and elytra.

Larger than *I. oratoria* and more robust. Head transverse, a little less than twice as broad as pronotal dilatation; facial clypeus about one and half times as broad as high, with upper keel not sharp, slightly curved, developed in the middle only and disappearing towards the eyes, with short vertical median carina, extending from upper margin to the middle of clypeus, where there are two raised points; other four raised points are at the angles of clypeus. Occiput distinctly convex. Pronotum rather thick; prozona slightly narrowed anteriorly, with parabolic apex, with feeble median longitudinal furrow; metazona about twice as long as prozona, gradually narrowed posteriorly in its fore half, while in the hind half its sides are parallel; margins of pronotum expanded. Elytra extending but a little beyond the apex of abdomen, about three times as long as they are in the broadest part wide; preradial area widened in its basal third and rather suddenly narrowed towards the apex; the venation agrees with this in *I. oratoria*. Wings distinctly shorter than elytra, with apex parabolic; hind margin almost straight. The armure of fore legs much the same as in *I. oratoria*, but the coxæ are more strongly spined and granulated. Supraanal plate rounded; cerci rounded, rather thick. Subgenital plate with hind margin rather broad, slightly convex.

Greenish-pale; fore tibiæ with inner surface reddish; fore metatarsus black beneath. Coloration of wings as in *I. oratoria*.

Length of body	41 mm.
Width of head	6,5
Length of pronotum	13,5
„ metazona	9
Maximal width of pronotum	4,5
Minimal „ „	3
Length of elytra	29
Maximal width of elytra	8,5
Length of wings	24,5
„ „ fore coxæ	9
„ „ femora	11,5
„ „ „ tibiæ	6
„ „ hind femora	11
„ „ „ tibiæ	10,5

Four male specimens in the British Museum from Bushire, S. W. Persia taken in September 1890, by W. D. Cumming.

The most striking differences from *I. oratoria* are: the form of clypeus, which in *oratoria* is more than twice as broad as high, with well developed upper carina; the form of pronotum and especially the relative length of prozona and metazona; the length and form of elytra. Co-typic specimens are of brick-reddish general coloration, but I am not sure that this coloration is natural and not the consequence of immersion in spirit.

8. IRIS SPLENDIDA, sp. n.

♀. About the size of *I. oratoria*, L., but more robust. Antennæ thin, setaceous. Frontal clypeus about twice as broad, as high, flat, with two small

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tubercules in its middle, its upper carina not sharp, but fully developed, rounded; vertex with two lateral furrows narrow, but very distinct. Eyes egg-shaped; inner orbits slightly emarginate in upper part. Pronotum rather broad; its margins denticulate; fore margin semicircular; sides in prozona and in metazona parallel; coxæ dilatation but a little wider than prozona, while metazona is distinctly more narrow; prozonal disc very convex, with two small oblique impressions near its apex; its longitudinal sulcus scarcely perceptible in the hind part only; transverse sulcus not interrupted, narrow, but very distinct, straight, with ends directed forwards; metazona twice as long as prozona, less convex, slightly selliform in profile, with two shallow impressions just behind the coxæ dilatation, with middle carina entire, though feeble, better developed in the hind part; the whole surface of pronotum, especially the middle part of metazona, bears scattered small granules; hind margin widely rounded, with slight, but sharp, emargination in its middle. Elytra shorter than abdomen, entirely coriaceous, slightly widened towards the apex, which is very widely rounded. Wings semicircular. Anterior coxæ with numerous densely placed acute tubercles beneath; interior surface with an irregular row of callous tubercles; upper external carina armed with eight obtuse spines, with minute acute spinules, placed in interspaces; upper surface slightly convex, smooth, with a few scarcely perceptible spinules, placed in a longitudinal row along the middle. Fore femora and tibiæ with an armure typical for the genus. Supraanal plate semi-elliptical, feebly carinated along its middle. Cerci short, thick, rounded. Subgenital plate with apex divided in two lobes.

General coloration greyish-yellow. Spines of fore femora and tibiæ brownish, darker towards the tips. Fore tibiæ orange red beneath. Fore metatarsi black on the inside, except the apices. Wings violaceous-black; humeral field rose-violaceous, with an oval black spot near the apex; the whole outer margin with a bright sulphurous border about 2-3mm. broad.

Length of body	48 mm.
Width of head	6
Length of pronotum	12,5
„ metazona	8,5
Width of prozona in its middle	4
„ metazona „ „	3,5
„ „ coxal dilatation	5
Length of elytra	17
Width of elytra in their middle	7
Length of wings	15
Width „ in their middle..	12
Length of anterior coxæ	9
„ „ femora	11
„ „ tibiæ	5,5
„ hind femora	10

The type is unique. It was brought home from Afghanistan by Dr. Aitchison of the Afghan Delimitation Commission, but somehow, probably because it had not been set out, it remained unnoticed and was not recorded by W. Kirby, who worked out the collection of the said Commission.* The species is so conspicuous by the splendid coloration of its hind wings, that there is no need for its comparison with other known species of the genus.

9. HESTIASULA BRUNNERIANA, Sauss.

Quetta, Baluchistan, 1 ♀ (British Museum).

The single poorly preserved specimen agrees fairly well with Saussure's original description, as well as with Wood-Mason's drawings (Journ. Asiat. Soc., Bengal,

* Trans. Linn. Soc., London, second series, Vol. V, part 3, pp. 137-14..

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1884, Vol. liii, pl. xiii, fig. 1a, 1b.) which according to the author (Revis. Mantid., 1889, p. 22) presents the same species. The drawing of the head is, however, not quite exact, since it presents the lower surface of frontal appendix as convex, while it is entirely flat, as rightly described by Saussure. This species has been known from Sylhet, Calcutta and Mysore; Quetta is, therefore, the most north-western known point of its distribution.

10. BLEPHAROPSIS MENDICA NUDA, Giglio-Tos.

1917. *Blepharopsis nuda*, Giglio-Tos, Bull. Soc. Ent. Ital., xlviii, p. 70 (of separate copy.)

Numerous specimens in British Museum from Arabia, Sinai, Mesopotamia, Quetta, etc.

The characters of *nuda* are not quite constant; especially variable and not characteristic for *nuda* is the degree of hairiness of the pronotum, on which Giglio-Tos has based his species. On the other hand the form of femoral lobes, specially those of middle femora, is rather constant: while in typical *mendica* (from Portugal, Canaries) these lobes are scarcely denticulate at all, the specimens from Desert Asia have the lobes strongly spined. As this character is, however, also liable to individual variation, I think it more right to regard *nuda* as but an Eastern geographical race of *mendica*.

Phasmidæ.

11. BURRIA LONGIXIPHA, Br. Watt.

Aden, Arabia, 1 ♀ (British Museum).

The genus and this species has been hitherto known from the African Coast of the Red Sea.

Locustidæ.

12. ACRIDIUM SUBULATUM, L.—Baghdad, ii. 17 (Bombay N. H. Society).

13. ACRIDELLA ROBUSTA, Uvar.—Persia: Pusht-i-koh, Chekerava, 540 m. above sea-level, 1907, de Morgan (Paris Museum).

14. ACRIDELLA MINIATA, Kl.—Amara, Mesopotamia, viii-ix. 16., Lt.-Col. F. P. Connor (Bombay N. H. Society).

15. ACRIDELLA ANTENNATA, Krauss.

One male and two females were taken at Ktubu, Arabia, by G. W. Bury.

The species is easily recognised by its very long antennæ and strongly attenuate hind angle of pronotum, apart from the peculiar dark colofation of wings.

16. PLATYPTERNA TIBIALIS, Fieb.—Arabia, Percival and Dodson, 2♂♂, 2♀♀, (British Museum).

17. PLATYPTERNA PICTIPES, sp. n.

♀. Of medium size for the genus. Antennæ rather short (their exact length unknown, the tips being broken), moderately compressed and widened in basal part.

Front moderately reclinate, smooth, but not shining; frontal ridge parallel, slightly dilated near the ocellum, gradually and very feebly widened towards the clypeus; fastigium of vertex seen in profile subequal to one-half of the length of an eye; foveolæ reniform, rather broad, curvate, not strongly impressed, with margins rounded, the upper margins being especially obtuse and low, while the lower ones are better developed; vertex seen from above obtuse, rotundato-triangular at the apex, as broad, as long, convex, with thick, but very low, shining median carina. Eyes oval, oblique. Pronotum feebly, but distinctly constricted in prozona; lateral keels parallel between the fore margin and the second transverse sulcus, gradually diverging behind the latter, slightly convex in about the middle of metazona; median keel sharp, straight, interrupted by the third sulcus; metazona distinctly shorter than prozona, distinctly convex and raised above the level of prozona; hind margin obtusely angulate, with the angle itself not rounded; lateral lobes rather convex, narrowed downwards, with fore margin slightly sinuate, lower margin feebly bisinuate, with a very

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minute obtuse angle in the middle, hind margin straight, feebly sinuate ; fore and hind angles of lobes a little more than 90 , rounded. Elytra very long, parallel-sided. Hind femora moderately broad, rather robust, subapical filiform part not developed.

General coloration is that of sand. Head with small brownish spots, forming two occipital and two postocular stripes. Pronotum with lateral keels shining, paler than disc ; lateral lobes darker along their upper margin and with a narrow whitish border beneath. Elytra sand-coloured in the basal fifth part and colourless in the rest, with a longitudinal row of brownish spots in the intercalate area and 3-4 smaller and more feebly coloured spots in the apical third, just behind the second radial vein ; several feebly coloured spots are also scattered on the whole apical half of elytra ; all veins and venules are sand-coloured with small irregular darker knots. Wings hyalinous ; veins, especially near the apex, brownish. Hind femora with superno-median area of the general coloration, while the externomedian area is whitish ; inner surface unicolorous ; inner genicular lobe with a round dark-brown spot. Hind tibiæ violaceous, their upper surface paler, especially towards the base ; spines pale basally, with brown tips.

Length of body	.. ..	33, 5 mm.
„ pronotum	.. ..	6
„ elytra	.. ..	30, 5
„ hind femur	.. ..	15, 5

Type : Muscat, Arabia, G. Jayakar.

This species seems to be related to *P. geniculata*, Bol. (Novit. Zool., *XX*, 1917, p. 608, No. 9) from Algerian Sahara, but it is well characterised by the structure of frontal ridge, foveolæ of vertex, shape of pronotum and coloration of hind tibiæ.

18. Dociostaurus crassiusculus, Pant. (=*hauensteini* Bol.).—Persia : Poush-e-kouh, Arkovaz. J. de Morgan, 1904 (Paris Museum).

19. Dociostaurus maroccanus, Thunb.—Persia : Abadeh, Peter Paschen (Bombay N. H. Society).

20. Ramburiella truchmana, F. W.—Syria, Aleppo, F. G. Aldous (British Museum).—The genera *Ramburiella*, Bol. and *Pallasiella*, Kirby, are evidently identical, since *Ramburiella hispanica*, Ramb. and *Pallasiella truchmana*, F. W., are undoubtedly congeneric. As Bolivar's name for the genus is the oldest of the two, the genus must be called *Ramburiella*, and it includes three species : *R. hispanica*, Ramb .,*R. truchmana*, F. W. and *R. bolivari*, Kuthy.*

21. Æolopus thalassinus, Rossi.—Baghdad, ii., 17 (Bombay N. H. Society).

22. Æolopus strepens strepens, Latr.—Syria, Aleppo, F. G. Aldous ; Baghdad (British Museum) ; Persia : Susa, J. de Morgan (Paris Museum).—This Mediterranean species has never been previously recorded from the Desert subregion and its occurrence in Baghdad and Susa in the typical form is quite interesting, since in S. W. Persia another race occurs, which is described below.

23. Æolopus strepens desertícola, subsp. n.

Differs from the typical Mediterranean form in the following characters :—

Pronotum more distinctly constricted, less convex above ; elytra somewhat longer ; general coloration brownish-grey ; elytra with wider light transverse bands ; wings feebly infumate apically ; hind femora with black points along the lower carina of the area externomedia and with three indistinct fasciæ in the same area ; inner side of femora pale with two black fasciæ ; hind tibiæ bluish with black base, and a pale subbasal ring, followed by a dark grey ring.

* Described as *Stethophyma bolivari* Kuthy (Ann. Mus. Hung., 1907, p. 431), and again by me as *Arcyptera elegans*, Uvar. (Horæ Soc. Entom. Rossicae, Vol. 39, 1910. p. 370 ; see also Bull. Mus. Caucase, xii, 1919, p. 156); this species is very closely related to *R. hispanica*, Ramb. and is possibly but a geographical race of the latter

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		♀
Length of body	.. ..	20 mm.
„ pronotum	.. ..	4
„ elytra	.. ..	19, 5
„ hind femur.	.. ..	12

Described from one male specimen, taken at Kazvin, N. W. Persia, 25, viii. 19, by P. A. Buxton.*

24. LERINA ÆOLOPOIDES, sp. n.

♂. Of the size of *L. œdipodioides*, Bol., but more compressed laterally. Antennæ very feebly flattened and scarcely dilated apically. Head in profile distinctly reclinate; frontal ridge gradually, though feebly, widened towards clypeus, shallowly, but distinctly, impressed, with margins raised, rather sharp; facial keels raised, almost straight. Fastigium of vertex distinctly longer than broad, pentagonal, with apex much attenuate, acute; lateral margins raised, sharp, the anterior ones feebly concave; surface very feebly sloping forwards, slightly concave. Temporal foveolæ elongate, strongly narrowed anteriorly, triangular, feebly curvate, shallow, with raised margins. Eyes slightly higher than broad, less rounded anteriorly than posteriorly. Occiput with its surface uneven. Pronotum distinctly constricted laterally, much alike in its shape to that of *Æolopus strepens*. Latr.; disc subtectiform, feebly narrowed anteriorly; median keel raised, slightly lowered behind the first transverse sulcus, interrupted by the hind sulcus, which is placed distinctly before its middle; metazona with its hind angle acute; lateral keels scarcely perceptible in the fore part of prozona, very obtuse in metazona; lateral lobes higher than long, with their lower margins oblique in the fore part; their fore angle obtuse, hind angle straight, widely rounded. Elytra with the fore ulnar vein sinuate; false vein in discoidal area thick, distinctly transversely serrulate, approaching apically to the hind radial vein; interulnar area more than twice as broad as the discoidal area, with the false vein distinct only near the base of the area, the rest of the latter being irregularly reticulated; furcal branches of the ulnar vein, as well as the false vein in the interfurcal area and transverse venules in the same area, are distinctly thickened, callous.

General coloration reddish-sandy with black and grey points and designs. Antennæ unicolorous. Face whitish; frontal and facial keels with black longitudinal spots. Pronotum with numerous blackish points. Elytra with three broad castaneous fasciæ: sub-basal, median and pre-apical, all reaching the anal area, but not extending into it; interspaces between the fasciæ whitish; apex hyaline; anal area sandy. Wings feebly greenish basally, with an indefinite infumate preapical fascia, not reaching the inner margin. Hind femora outwardly reddish-sandy in the basal half and blackish apically, with a reddish ring before the knee; innerside and lower sulcus totally black, except a pale preapical ring; knees blackish, except the reddish upside. Hind tibiæ black, with apex and a narrow subbasal ring ivory white. Hind tarsi ivory white, with second joint brownish. Abdomen reddish with 3-6 segments black laterally.

Length of body	.. .. 16, 5 mm.
„ pronotum	 4
„ elytra	 18
„ hind femur	.. .. 9, 5

The unique specimen of this species has been taken by A. S. G. Jayakar at Muscat, Arabia (British Museum). It is with some hesitation that I put this species into the genus *Lerina*, Bol. which has been described from one Indian

* Specimens of this race recorded by me (Journ., Bombay N. H. Soc., Vol. xxvii, 1921, p. 804) from Mesopotamia, seem to belong to a distinct species, which I am unable to identify with certainty now, owing to scarcity of material.

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species—*L. œdipodioides*, Bol. The new species itself is very striking by its close resemblance to *Æolopus strepens*, Latr., by venation of elytra and by coloration of the same and of hind legs.

25. LERINA BUXTONI, sp. n.

♂, Of the size and habitus of the Indian *L. œdipodioides*, Bol. Antennæ slightly flattened, feebly dilated towards the apex; last joint truncate. Front in profile distinctly reclinate; face impresso-punctate; frontal ridge subparallel, rather suddenly narrowed near fastigium and very feebly widening towards clypeus, not reaching the latter, flat, with a small impression below the ocellum, with lateral margins obtuse; facial carinæ obtuse, rather thick, feebly curvate, Vertex slightly sloping; fastigium much longer than broad, elongato-hexagonal, narrowly truncate anteriorly, slightly concave, with raised margins; foveolæ long and straight, strongly narrowed anteriorly, almost triangular, shallow, with margins not sharply delineate. Eyes almost vertical, distinctly higher than broad, with fore margin straight. Pronotum feebly constricted and rounded in prozona, which is distinctly longer than metazona; median keel in prozona scarcely distinct, interrupted by two transverse sulci, in metazona sharp, though low; lateral keels in the shape of small, low tubercules near the fore margin of prozona and very obtuse in metazona; fore margin of the pronotal disc slightly prominent, with a small emargination in the middle; hind margin obtusely angulate, widely rounded; lateral lobes much higher than long, with lower margin oblique in its fore part, fore angle obtuse, hind angle about 90° rounded. Elytra extending beyond the hind knees; interulnar field about twice as broad as discoidal, with an irregular false vein; intercalate vein in discoidal area approaching apically to the radial vein; two furcal veins and the false vein in the furcal area, as well as transverse venules in the same area thick, callous. Venation of wings as in *L. œdipodioides*, Bol. Hind femora short, broad; hind tibiæ shorter than femora.

General coloration is that of sand, with numerous greyish and blackish points. Antennæ brown with numerous pale rings. Pronotum above brick-reddish, with two indefinite blackish longitudinal sinuate fasciæ. Elytra with three irregular blackish bands and scattered brownish-grey spots. Wings hyalinous, very feebly coerulescent basally. Fore and middle legs with several brown transverse fasciæ. Hind femora with two irregular transverse fasciæ in area externomedia and with three on the upper side; inside black, except a post-median and a preapical pale fascia; knees black from inside and grey outwardly. Hind tibiæ ivory white, with base, median and preapical rings, and tips of spines, black.

Length of	body	19, 5 mm.
,,	pronotum .., ...	3, 5
,,	elytra	19
,,	hind femur	9, 5

The unique type specimen has been taken by P. A. Buxton at Amara, Mesopotamia, 10. viii, 18, together with a paratypic male, which agrees with the type in all morphological characters, but has the elytra unicolorous, without any trace of fasciæ or spots.

26. ŒDALEUS NIGROFASCIATUS, De Geer.—Persia: Bakhtyari Mountains, 1500-4500 m., J. deMorgan, 1904 (Paris Museum).

27. SCINTHARISTA NOTABILIS BRUNNERI, Sauss.

1884. *Scintharista brunneri*, Saussure, Prodr. Oedipod., p. 121, No. 1.

1888. *Quiroguesia brullei* var. *blanchardiana*, Saussure, Add. ad Prodr. Œdipod., p. 35.

The most careful examination of the cotypes of *blanchardiana*, Sauss., which are in British Musuem, and comparison of them with original description of *brunneri*, Sauss., leaves no doubt in the identity of this form. It is evident, therefore, that the genera *Scintharista*, Sauss., and *Quiroguesia*, Bol., are identical

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and Saussure's name has priority. I consider the Asiatic *Sc. brunneri*, Sauss., as a mere geographical race of the Western Mediterranean *Sc. notabilis*, Walk. (=*brullei*, Sauss.), the difference between them being too insignificant for separation of species. This race occurs in two different colour forms, which might be taken together, one with rose wings and another with yellow wings; it is distributed all over the deserts of S. W. Asia, from North Kashmir and Bombay to Ordubad in Transcaucasia and to Southern Arabia, occurring even at Massowah, on the African Coast of the Red Sea.

Specimens in British Museum are from following localities:—Aden, Arabia (Co-types of *blanchardiana*, Sauss).; Muscat, Dr. Jayakar; Malakand, N. India, A. Begbie; Campbellpore, N. India; Hunza, N. Kashmir; Quetta, Baluchistan. In the Bombay Natural History Society there is one female from Teghab Kelat, Baluchistan, 28, viii, 17, J. E. B. Hotson.

28. MORPHAERIS FASCIATA, Thunbg., ab *sulcata*, Thunb.—Syria, 1 ♂ (British Museum).—Full synonymy of this species is given by me in another paper on the Indian Orthoptera. Annals and Magazine of Natural History, 1921, p. 488).

29. MIOSCIRTUS WAGNERI Ev.—Fao, Persian Gulf, v., 91, W. D. Cumming, 2 ♀ ♀.—Specimens from Mesopotamia and Southern Persia are somewhat larger than those from the original locality of the species, which is Sarepta, North from Caspian Sea; if this difference proves to be constant in large series of specimens, a distinct southern geographical race may be distinguished, which might be called subsp. *rogenhoferi*, Sauss. (described as *Conozoa rogenhoferi*, Sauss.).

30. PYRGODERA ARMATA, F. W.—Jebel-Hamrin, River Diala, Mesopotamia, vii, 18, 1 ♂, H. D. Piele; Bakhtyari, W. Persia, 29, vi. 11, 1 ♂, G. B. Scott (British Museum); Abadeh, W. Persia, P. Paschen (Bombay Society); Eivar-i-kerkha, Persia, iv. Vol. 1907, I. deMorgan (Paris Museum).

31. SPHINGONOTUS SAVIGNYI, Sauss.—Abadeh, Persia, vii-viii, P. Paschen (Bombay Society).

32. SPHINGONOTUS BRUNNERI, Sauss.—Abadeh, Persia, vii-viii, 1 ♀, P. Paschen (Bombay Society).

33. SPINGONATUS BALTEATUS, Serv.—Abadeh, Persia, vii-viii, 1 ♂, 2 ♀ ♀, P. Paschen (Bombay Society).

34. SPHINGONOTUS OCTOFASCIATUS, Serv.—Abadeh, Persia, v-vi, 2 ♂ ♂, 3 ♀ ♀, P. Paschen (Bombay Society).

35. HELIOSCIRTUS MOSERI, Sauss.—Benn-Chah-Bah, Baluchistan, 20. viii. 17, 1 ♀, J. E. B. Hotson (Bombay Society).

IRANELLA, gen. nov.

General habitus not unlike that of *Sphingonotus*, but elytra and wings only half developed.

Head rather large and thick. Front vertical; frontal ridge above ocellum flat, broad, strongly punctured, below ocellum suddenly depressed and narrowed, with lateral margins raised, and totally disappearing half-way between ocellum and clypeus; face broad; facial keels strongly raised, rather thick, vertical, diverging downwards; lateral ocelli touching the eyes and lateral margins of fastigium; fastigium strongly sloping, slightly convex, strongly rugose, with a short median sulcus which is widened anteriorly, then narrowed again and passing gradually into frontal ridge; vertex between the eyes slightly concave, broad, with lateral margins straight, parallel, with a low median carinula, bifurcate anteriorily, very narrowly sulcate and extended into the occiput, the latter strongly rugose. Pronotum in prozona constricted and cylindrical intersected by three deep transverse sulci, the second one being bifurcate in that disc, so that the latter is intersected by four sulci; lateral keels in prozona distinct, but interrupted in the middle; metazona equal in length to prozona, slightly convex, strongly rugose and densely covered with small tubercules, while tubercules in prozona are large, but not densely placed; median carina in prozona replaced by a scarcely perceptible sulcus, while in metazona it is

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well developed, very thin, linear; hind angle of metazona straight, rounded; lateral lobes about as long as high, strongly widened upwards, their fore margin slightly sinuate, lower margin oblique and very feebly sinuate in the fore part, hind margin very oblique, almost straight; hind angle obtuse, rounded; prozona in lateral lobes more than twice as long as metazona. Prosternum with its fore margin produced in a large, trapezoidal collar, widened and slightly bi-sinuate apically, with outer angles a little less than 90°. Pectus very broad; mesosternal lobes trapezoidal, a little broader than long, with inner and hind margins straight, inner angles sharp, about 90°; mesosternal interspace broader than long; metasternal lobes extremely short, their interspace equal in breadth to the mesosternal one. Tympanum very large, oval. Fore and middle tibiæ armed with 2-3 small spines both on outer and inner side near the apex. Hind femora rather short, thick, with upper carina denticulate; lower carina not widened, almost straight. Hind tibiæ slightly incurved and widened towards the apex, with 9 inner and 8 outer spines, without subapical spine on the outside; outer spures twice as short as the inner ones. Elytra just a little longer than abdomen, coriaceous, rugose, with the fore margin gradually rounded, hind margin almost straight, apex widely rounded; veins rather irregular, sinuate; pre-radial area broad; discoidal area open with an irregular intercalate vein; anterior ulnar vein straight, reaching the apex of elytra; anal area almost equal in breadth to one half of the whole elytra. Wings shorter than elytra, circular.

Genotype: *Iranella eremiaphila*, sp. n.

36. IRANELLA EREMIAPHILA, sp. n.

♂: Greyish ochraceous, with whitish and grey marks. Elytra beneath with several confluent round black spots in the pre-radial area and four smaller and lighter coloured ones in discoidal area; all these spots are slightly conspicuous (grey) on the upper side; the hind radial and humeral veins, as well as all transverse venules of the anal field bluish-black on the lower side, but not distinctly coloured on the upside of elytra; hind femora slightly rose in the basal half of the inner side, with two scarcely perceptible greyish transverse fasciæ in area extreno-media; knees grey. Hind tibiæ bluish-grey in the basal half, slightly rose apically, with spines sanguineous, black tipped.

Length of body	15 mm.
,, pronotum	5, 5
,, elytra	11
Maximal width of elytra	5
Length of hind femur	10

The type of this striking insect is unique. It has been taken by P. Paschen in Abadeh, Persia, vii-viii, 1916.

This insect somewhat resembles *Sphingonotus* in the shape of the head and pronotum, but the disc of the latter is intersected by four sulci; short elytra and wings give it a general appearance quite unlike any other genus of *Œdipodinæ*. The black spots on the underside of elytra remind one of the Mantid genus *Eremiaphila*; their biological meaning is quite incomprehensible without a careful study of the biology of the insect in its natural surroundings.

37. ŒDIPODA GRATIOSA, Serv.—Persia; Abadeh, vii-viii. 16, P. Paschen (Bombay N. H. Society).

38. ACROTYLUS LONGIPES, Charp.—Arabia: Muscat, 1 ♂, A. S. J. Jayakar (British Museum).

39. ACROTYLUS INSUBRICUS, Scop.—Persia: Abadeh, vii-viii, 16, P. Paschen (Bombay N. H. Society).

40. TMETHIS CISTI, F.—Syria: Aleppo, F. G. Aldous (British Museum).

41. TMETHIS SAUSSUREI, Uvar., ab. VIOLACEA, n.—Differs from the typical blue-winged form only by the violaceous colour of wings, all morphological

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characters, as well as dimensions, being the same. Types and several cotypes from Abadeh, Persia, P. Paschen (British Museum and Bombay N. H. Society).

42. TMETHIS HOTSONI, sp. n.

♀. Large, laterally compressed. Head narrow, prominent above pronotum; front reclinate; frontal ridge expressed above ocellum only, totally and abruptly disappearing below it; fastigium of the vertex strongly sloping, longer than broad, slightly widened anteriorly, transversely rugose; eyes very prominent, oval; occiput with an irregular median carina. Pronotum laterally compressed, especially so in prozona, which is considerably narrower and shorter than metazona; prozona strongly tectiform, with median crista thick, deeply intersected by three transverse sulci, the hindmost of which is especially deep; metazona as high, as prozona, thick, tectiform in its fore half, with thick elevated carina, which disappears on the apical third; hind angle acute, rounded; lateral lobes much higher, than long, with fore margin slightly sinuate; lower margin sinuate anteriorly; hind angle of lobes straight, rounded; whole pronotum is covered with rather large, but not dense callous tubercules; metazona rugulose. Elytra very long, extending far beyond hind knees. Hind wings a little shorter than elytra. Mesosternal lobes nearly triangular, their inner margins being strongly oblique; interspace much broader, than long. Metasternal lobes widely separated. Hind femora elongate, granulose, with upper margins slightly undulate; lower margin straight. Second abdominal segment raised posteriorly in a rather thick median protuberance.

General coloration whitish-grey; pronotum feebly brick-reddish. Elytra ochraceous-grey, with indistinct grey marks. Wings light greenish-blue, with a 4-5 mm. wide black band, which starts from the middle of fore margin and runs straight backwards to the hind margin but does not reach it by about 5 mm., suddenly turning under a straight angle inwardly and reaching the inner margin; two apical lobes brown. Hind femora coeruleous beneath, light blue inwardly, with inner knee lobes dark blue. Hind tibiæ with inner and upper surfaces blue, with a pale ring near the base and a red apical spot. Abdomen pale with hind margins of basal tergits blue-black.

Length of body	.. ..	65 mm.
,, pronotum	.. ..	14
,, elytra	.. ..	56
,, hind femur	.. ..	24

The female of this species has been taken by Lt.-Col. J. E. B. Hotson in Mand, Baluchistan, 29, iv. 1916, on sand; it bears the remark, "plentiful," but only one rather damaged specimen has been included in collection sent to British Museum by the Bombay Society. The species belongs to the group of *T. gibber*, St., but is bigger, more constricted laterally, with longer elytra, than any other known species, and is also easily recognised by narrow band of wings, bent under a right angle.

43. PŒCILOCERUS VITTATUS, Klug.—Arabia: Aden, Ktubu (British Museum).

43*a*. PŒCILOCERUS VITTATUS var. CALOTROPIDIS, Karsh.—A very large series of specimens in British Museum from Hadramaut, Arabia.

44. PŒCILOCERUS PICTUS, F.—Baluchistan: Quetta (British Museum); Ormarah, W. Cumming; Nal, 21, ix. 17 and Greshag-Kalat, 28, viii, 17, J. E. B. Hotson (Bombay N. H. Society).—These are the most north-western records of this Indian species.

44*a*. PŒCILOCERUS BUFONIS, Klug. and ab. *vulcania*, Serv.—Very numerous specimens in Paris Museum from Sinai, J. Couayt, 1908, belonging both to typical form and entirely black ab. *vulcania*, together with several of intermediate coloration.

45. PŒCILOCERUS ARABICUS, sp. n.

♂. Size rather small for the genus. Antennæ feebly flattened, distinctly longer than head and pronotum together. Front not very oblique, scarcely concave

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in profile; frontal ridge between antennæ strongly compressed, very narrowly sulcate, the sulcus slightly widened towards ocellum, suddenly narrowed below it, gradually widened and becoming more shallow towards the clypeus, not reaching the latter; lateral facial keels more raised near the eyes, lowered below their middle. Fastigium of vertex attenuate, convex, rugosely punctate, with apex deeply furrowed. Eyes very prominent, short, oval. Occiput with a low median carina. Pronotum short, convex, its whole surface feebly coriaceous; transverse sulci very feeble; median carina undeveloped in prozona and scarcely perceptible in metazona; the latter a little shorter, than prozona; hind margin very widely rounded; lateral lobes with fore angles very obtuse, hind angles obliquely truncate. Elytra narrow, extending a little beyond hind knees, marginal field feebly widened basally and gradually narrowed towards apex, the basal dilatation being, therefore, not as well marked, as in most other species of the genus; apex of elytra elliptical. Wings shorter than elytra, with disc coloured. Hind femora slender, narrow. Supraanal plate obtusely triangular. Cerci short, slightly compressed, obtuse. Subgenital plate thick, rounded, carinated apically.

General coloration grey. Antennae with basal joints blackish, with apical two-thirds irregularly annulated with brown, black and pale rings; apical joints black. Face pale-brownish. Fastigium blackish from above. Occiput of darker shade than the cheeks. Pronotum unicolorous grey, with hind margin narrowly shining black. Mesonotum and metanotum bluish-black. Elytra ash-grey, with numerous orange-yellow speckles. Wings rose, except the apex and hind border, which are hyalinous; veins in apical part brownish. Abdomen dirty-yellow, with brown rings at the base of each segment. Fore and middle legs uniformly brownish-grey. Hind femora grey on the outside and black inwardly. Hind tibiæ dark violaceous, with base almost black; spines pale with black tips. Two basal joints of hind tarsi pale with brown spots; last joint violaceous.

Length of	body	33 mm.
,,	antennæ	12, 5
,,	pronotum	7
,,	elytra	25, 5
,,	hind femur	15

Arabia: Ktubu, G. W. Bury, 1 ♂ (British Museum).

This species is very well characterised by its coloration, as well as by morphological features, the shortness of pronotum and form of elytra rendering the best characters for separating it from its related species.

46. PYRGOMORPHA CONICA, Ol.—Amara, Mesopotamia, F. P. Connor (Bombay Society).

47. TROPIDAUCHEN ESCALERAI, Bol.—Persia, 1 ♀ (British Museum). This species differs from *T. securicollis*, Sauss. by but unimportant characters and is, probably, only a geographical form of the latter species.

48. TROPIDAUCHEN CULTRICOLLE, Sauss.—Afghanistan: Hari-rud valley, 1 ♂, 1 ♀, 1 larva; Badghis, 1 larva (British Museum).—These specimens have been recorded by Kirby (Trans. Lin. Soc. London, Zool. v, 3, p. 139, No. 11) as *Eunapius granosus*, Stal.

49. DERICORYS ALBIDULA, Serv.—Persia: Fao, 1891, W. Cummings (British Museum).

1839. *Dericorys albidula*, Serv., Ins. Orth., p. 639.
1853. *Cyphophorus tibialis*, Fieber, Lotos, iii, p. 121, No. 2.
1875. *Derocorys acutispina*, Stal, Bih. Sven. Akad., iii (14), p. 27, No. 1.
1889. *Derocorystes curvipes*, Redt., Wien Ent. Ztg., viii, p. 29, No. 5.
1913. *Dericorys albidula*, Bolivar, Novitates Zool., xx, p. 613, No. 23.

I am fully convinced by the most careful study of descriptions of all above-quoted species, that there exists only one large species of *Dericorys*, which is

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distributed from Transcaspia to Sahara and from Persian Gulf to Syria. The characters given by Bolivar (l.c.) as separating *albidula*, Serv., from *curvipes* Redt., are not specific but individual.

50. TROPIDOPOLA OBTUSA, sp. n. (fig. 2).

In studying a rather extensive series of *Tropidopola* (12♂♂, 13♀♀) taken in different parts of the Desert region, and comparing these specimens with those of *Tropidopola cylindrica*, Marsh, from Greece and Macedonia, I came to the conclusion that the desert species is not *cylindrica*, as it has been identified by all authors, including myself, but is well distinct from it. As it, however, agrees with *cylindrica* in all characters, except structure of the head, which is quite different and very constant throughout the series, I think it unnecessary to give a full description of the new species, and the following key together with drawings must be sufficient for separating it from *cylindrica* :—

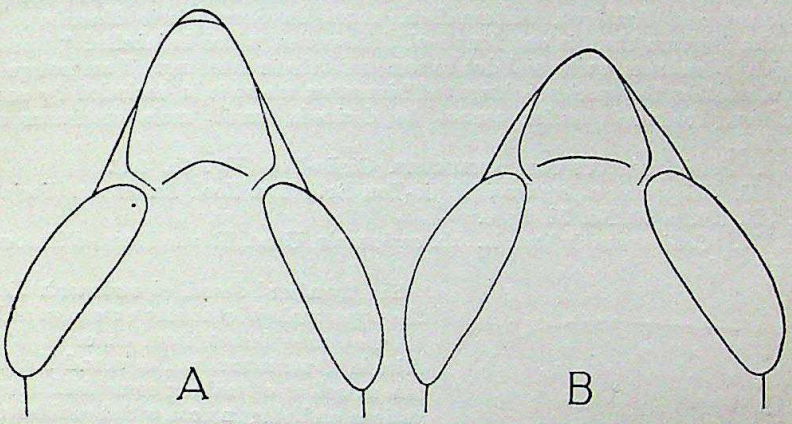

Fig. 1. A. *Tropidopola cylindrica* Marsh.
B. *Tropidopola obtusa*. sp. n.

1 (A) Head not thicker than pronotum, gradually narrowed anteriorly. Front long, more reclinate, in profile quite straight; frontal carinæ straight, converging gradually towards fastigium. Fastigium of vertex (fig. 1) distinctly longer than its base wide; its sides straight, apex subacute. Eyes more elongate. Antennæ distinctly flattened with median joints subquadrate.....*T. cylindrica* Marsh.

2 (B) Head a little thicker than pronotum. Front shorter, less reclinate; in profile slightly convex; frontal carinæ subparallel, suddenly converging between the base of antennæ and fastigium. Fastigium of vertex (fig. 2) not longer than its base wide; its sides convex; apex rounded. Eyes shorter and broader. Antennæ scarcely flattened with median joints distinctly longer than wide. Length of body of the type (female) 35mm.: of pronotum 6, 5; of elytra 26; of hind femur 14, 5.....*T. obtusa*, sp. n.

The type is from Qualat-Salah, Mesopotamia, 6, i., 1918, P. A. Buxton. Other specimens of *T. obtusa* studied by me were from following localities:—

Mesopotamia: Amara, Basra, P. A. Buxton; S. Persia: Fao, D. Cummings, River Karun, Mohamarra, K. C. Mabbs (British Museum); Susa, J. deMorgan (Paris Museum).

Two specimens taken by Dr. Buxton in Mesopotamia (1♂ from Basra, 12, viii, 18 and 1♀ from Amara, 18, vii, 18) differ from all others by their light green coloration, which is more fresh in ♀, while the male is slightly brownish from above; both specimens are also larger than usual, and have longer antennæ

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consisting of more elongated joints, than may be seen in typical specimens of *obtusa*. Without studying a larger series of this form, I cannot decide whether those characters are sufficiently constant to be specific, and I propose in the meantime to designate it as var. VIRESCENS; n. The dimensions of the typical specimen (female from Amara, Mesopotamia) are, as follows :—Length of body 39 mm.; of pronotum 7 ; of elytra 28 ; of hind femur 16, 5.*

51. THISŒCELRUS (?) MORBOSUS, Serv.

1839. *Acridium morbosum*, Serville, Ins. Orth., p. 682, No. 44.

1870. *Caloptenus cincticollis*, Walker, Cat. Derm. Salt. Br. Mus. iv, p. 689, No. 29.

There is no doubt though the types of *cincticollis*, Walk., are lost, that this species is identical with *morbosum*, Serv., both insects having been described from Sinai ; I have seen two females from the same locality : Sinai, J. Couayt, 1909 ; desert Arabique, Mahamadieh, canal de Suez (Paris Museum). In British Museum there is one female of this species, which is labelled "Spain" which is doubtless wrong and due to some mistake in labelling. I am not quite sure, whether the species belongs to *Thisœcetrus*, where it is included by some authors, but the question cannot be decided, until male specimens are studied.

52. SPHODROMERUS CŒLEOSYRIENSIS, Giglio-Tos (Fig. 3c, 4c.).

1893. *Caloptenus cœlesyriensis*, Giglio-Tos, Boll. Mus. Zool. An. comp. Torino, viii. N. 164, p. 10, No. 51, fig. 4.

1914. *Calliptamus italicus*, L. , ab. *carbonaria*, Uvar., Revue Russe d'Entom., xiv, p. 10.

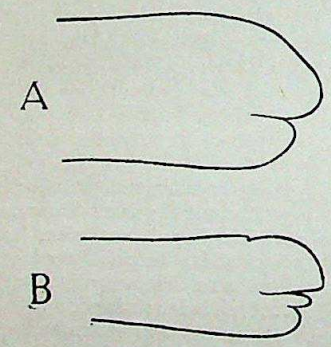

Fig 2. *Tips of the male cerci.*
A—*of Calliptamus cœlosyriensis*, G. T.
B—*of C. italicus, L.*

Shortly after I described *carbonaria* I had the opportunityof studying extensive series of the same insect from different localities in Transcaucasia, Persia and Kurdistan, as well as of making some field observations on living insects, which enables me to state, that it is quite a distinct species from *italicus*, L. The examination of a single male in British Museum from Syria (Aleppo) enables me to identify *carbonaria* with *cœlesyriensis*. The species is rather variable in the development of lateral keels of pronotum and, as its coloration also varies from pitch-black to reddish-grey or clay-yellow, it might be mistaken for *italicus*. It differs, however, from the latter species by shorter and broader hind femora, and, more distinctly, by the shape of end of male cerci, which in *italicus* is armed with two small teeth under the apical lobe, while in *cœlosyriensis* there is only one tooth ; these differences are clearly shown in figures (see fig. 2). This species is distributed from Syria to Turkestan (Ferghana) and from S. E. Transcaucasia to Central Persia (Teheran, in Caucasian Museum ; Pusht-i-Kuh, Paris Museum).

53. THISŒCETRUS ADSPERSUS, Redt.—Mesopotamia : Sinn-Abtar, vii, 16, Shortridge ; Amara, viii-ix, 16, Connor ; Baghdad, 13, ii.17 (Bombay Society).

* Specimens of *Tropidopola* from Algeria, whence I have studied only three examples, are more alike *obtusa*, than *cylindrica* in the shape of fastigium, but they differ by the frontal carinæ being gradually convergent, as in *clylindrica*. I propose to regard the Algerian *Tropidopola* as a geographical race of the desert *obtusa*, under the subspecific name *algeriana*, subsp. nova (type from Biskra, Algeria, W. I. H. King.

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54. THISCŒCETRUS DORSATUS, F.-W.—Mesopotamia: Sinn.-Abtar vi, 16, G. C. Shortridge (Bombay Society).

55. THISCŒCETRUS PULCHER, Bol.—Baluchistan: Gaza Kalah, I, ix, 1917, J. E. B. Hotson (Bombay Society).—The species belongs to Indian fauna and this is the most north-western record of its occurrence.

Tettigoniidæ.

56. EURYCORYPHA STYLATA, St.—El-Kubar, N. W. Arabia. G. W. Bury. 2 ♂ ♂ (British Museum).—The genus is essentially African in its distribution and the species is African, as well.

57. EUCONOCEPHALUS INCERTUS, Walk.

1869. CONOCEPHALUS INCERTUS, Walk.—Cat. Derm. Salt. B.M., ii, p. 320.

1891. CONOCEPHALUS BREVICEPS, Redt.—Verh. Zool.-Bot. Ges. Wien, p. 417.

To this species must be partly referred records on the occurrence in the deserts of S. W. Asia of *Hom. nitidulus*, Scop. The above synonymy is established by me after comparison of Redtenbacher's description with Walker's types of *incertus*. I have seen the specimens from the following localities:—Arabia: Fao, 27, x., 91, 1 ♀; Aden, 16, iii, 95, 1 ♀; Mesopotamia: Amara, P. A. Buxton, 1 ♀ (named by L. Chopard as *nitidulus*, Scop); Baluchistan; Omarah, W. D. Cummings, 1 ♀ (all in British Museum).

58. XIPHIDIUM FUSCUM TURANICUM, Sem.—Amara, Mesopotamia, viii-ix, 16-30, v. 17, F. P. Connor (Bombay Society).

59. DECTICUS ALBIFRONS, Cyr.—Mesopotamia: Amara, vii., 16, F. P. Connor; Sinn-Abtar, vii, 16, G. C. Shortridge.

60. TRIGONOCORYPHA ANGUSTATA, sp. n.

♀: Fastigium of vertex triangular, with middle sulcus broad and deep, open anteriorly. Pronotal disc rugulose, very feebly convex anteriorly and as feebly concave posteriorly; fore margin rotundately concave; hind margin circular with a very small emargination in its middle; lateral carinæ straight, feebly convergent anteriorly, more distinctly serrulate in prozona, than in metazona; transverse sulcus feeble, curved backwards in the middle, placed at the end of the basal third; lateral lobes forming a right angle with disc, distinctly higher than long; their fore margin very feebly concave, lower and hind margin widely rounded. Elytra reaching well beyond hind knees; marginal field strongly widened, but near its apical third rather suddenly narrowed, fore margin being distinctly concave and the apex of elytron lanceolato-attenuate; radial veins almost straight; first radial branch bifurcate, second one not divided; hind margin in apical half distinctly concave. Wings longer than elytra, with apex acute. Hind femora with two rows of numerous spinules beneath. Subgenital plate short, triangular. Ovipositor short, strongly recurved.

General coloration brownish (probably decolarated through preserving in some liquid); pronotal carinæ slightly darker; all other parts unicolorous.

Length of body	.. ..	26 mm.
,, pronotum	.. ..	6, 5
,, elytra	.. ..	37, 5
Width of ,, in the middle	.. ..	10
,, ,, in the apical fourth	..	6
Length of wings	.. .. ..	40
,, hind femur	.. .. ..	24
,, ovipositor	.. ..	6

The only specimen of this species is from Fao, Persian Gulf (British Museum). This is the fourth known species of the genus, the two previously known (*unicolor*, Stall, and *abnormis*, Br. W.) being Indo-Malayan in their distribution, and one has been described recently from Madagascar (*maxima*, Carl, Rev. Suisse Zool., vol. 22, No. 6, 1914, p. 167, pl. 5, fig. 5). Form of elytra in the new species is quite peculiar and the shape of fastigium of vertex, which is completely divided in two lateral parts by middle sulcus, presents another good specific character.

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Gryllidæ.

60. BRACHYTRYPES CHOPARDI, sp. n.

♂. Of the size and habitus intermediate between *membranaceus*, Drury, and *megacephalus*, Lef.

Head slightly broader than pronotum. Face flattened, vertical, in shape of a regular circle (its vertical diameter being equal to horizontal one). Fastigium of vertex with a not deep impression in the form of a half-moon. Ocelli as usual for the genus size; the middle ocellus placed a little lower than the line connecting lateral ocelli; the latter placed on the outer side of vertical keels which are distinctly convergent downwards and not extending beyond the base of antennæ; middle facial space between these keels trapezoidal, distinctly higher than broad, with a wide slightly raised coarsely lineato-rugose transverse band; in the middle of which there is a small tubercle with the median ocellum on it; below this band face is rugose, except a smooth shining oval space just beneath ocellum; lower part of face, between bases of antennæ, is slightly convex: below and a little outwardly from bases of antennæ, there are short vertical keels, slightly raised and obtuse. Clypeus with a distinct transverse keel. Occiput strongly convex, raised above pronotum, very sparsely and minutely punctured. Pronotum distinctly constricted in its hind part, but less so than in *megacephalus*; its length exceeds its basal width by a little; its apical width is subequal to one and a half of the length. Disc rugose, with a short smooth median line in the fore half. Fore margin slightly concave; hind margin straight. Lateral lobes a little longer than high, scarcely broadened downwards; fore margin and fore angle broadly rounded; lower margin straight, slightly ascending backwards; hind angle about 100°, rounded; hind margin vertical. Elytra about four and half times as long as pronotum Tympanal field slightly longer than broad. Harpa with three long and 1-2 short oblique veins. Speculum oblique, elongate; its externo-anterior margin straight; fore angle nearly straight, slightly rounded. Apical field occupies less than one-third of the whole length of elytra. Lateral field with 5 branches of radial vein and 8 oblique veins, with feeble transverse venules. Wings fully developed, extending about one-fourth their length beyond the apex of elytra. Fore tibia with a large oblique tympanum on the outer side, and with but a small one inwardly; apical tibial spurs short and obtuse, the two inner ones equal to one-third part of the first tarsal joint; the outer spur about one-half of the inner. Fore tarsi about twice shorter, than tibiæ; first joint as second and third together; its apex seen from beneath oblique, obtusely produced; second joint, equal to one-third of the first; third joint twice as long as second; claws thin, almost straight, with apex bent, acute. Middle tibiæ armed with four thick and short apical spurs, the two inner and lower outer one being subequal in length to each other, while upper outer is shorter. Hind tibiæ armed inwardly and outwardly with 3-4 irregular spines of different size and shape and with six apical spurs; upper inner spur is the longest, reaching about the middle of metatarsus, and incurved; two lower spurs short and rather thin, the inner of them being a little shorter than the outer; three remaining spurs are subequal in length to each other, about one-third of metatarsus, thick, straight. Metatarsus equal to one-half of tibia, armed with three short irregular spinules outwardly and four inwardly, and with two apical spurs, the outer spur being quite short, very thick and obtuse, while the inner reaches about the middle of the third joint of tarsus, thick, slightly recurved, with obtuse apex. Supraanal plate thick, with middle part impressed. Cerci slender long, with long perpendicular hairs. Subgenital plate acutely navicular.

General coloration brownish-pale. Face pale, with the suture between it and clypeus blackish-brown; trapezoidal space upwards from the middle ocellum and its lateral margins, as well as upper margin of antennæ impressions, castaneous: vertex light castaneous, the colour gradually fading in occiput

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with a pale median line bifurcate anteriorly, and two darker indefinite narrow submedian longitudinal fasciæ. Pronotum pale with fore and hind part of disc castaneous; the hind castaneous part being twice as broad as the fore one; both are connected by a longitudinal median castaneous fascia, including a pale median line; a round pale point near fore margin and another before hind margin; lateral lobes pale. All legs pale; hind knees with castaneous semilunar patches. Elytra not strongly infumate; wings hyaline, feebly infumate apically.

Length of body	.. ..	.. 34 mm
,, pronotum	.. .. ..	.. 6, 5
Width of ,,	anteriorly ..	.. 11, 5
,, ,,	posteriorly ..	.. 9
Length of elytra	.. .. ..	.. 24
,, wings	.. .. ..	.. 32
,, fore femur	.. .. ..	.. 9
,, ,, tibia	.. .. ..	.. 9
,, ,, tarsus	.. .. ..	.. 4
,, hind femur	.. .. ..	.. 20
,, ,, tibia	.. .. ..	.. 11
,, ,, tarsus	.. .. ..	.. 8, 5
,, ,, metatarsus	.. .. ..	.. 5, 5

Two males (type and paratype) taken at Ktubu, Arabia, by G. W. Bury in 1902.

I have the great pleasure in naming this interesting species after Dr. L. Chopard, who has done so much for increasing our knowledge of Orthoptera, and especially, of *Gryllidæ*.

The species is somewhat similar to *B. megacephalus*, Lef., but it differs from it in many important characters, as follows:—Head in *B. chopardi* is but a little broader, than pronotum; trapezoidal space between eyes higher than broad, while it is transverse in *megacephalus*. Pronotum in new species is relatively longer, less narrowed posteriorly; lateral lobes distinctly longer than high and but feebly widened downwards. Tympanal field of elytra is distinctly transverse in *megacephalus*, while it is as broad as long in *chopardi*; apical field is relatively longer. Apical spurs of fore tibiæ in *chopardi* are thick and much shorter than first joint of tarsus, while in *megacephalus* they are thinner and longer; apex of first joint of fore tarsi is in new species not truncate, as in *megacephalus*, but obtusely prominent. The larger apical spurs of hind tibiae (*i.e.*, all, except inner upper ones) are subequal to one-third of metatarsus, while in *megacephalus* they are almost as long as a half of metatarsus. From another related species, *B. membranaceus*, the new species differs partly by the same characters, as from *megacephalus*, but is most easily separated by the form of the head, which in *membranaceus* is not wider, than pronotum; pronotum in the latter species is not narrowed posteriorly; median ocellum in *chopardi* is placed on a very small tubercle, while in *membranaceus* this tubercle is very distinct; apical field of elytra in *membranaceus* is distinctly longer than one-third of elytra.

62. ACHETA CHALDEA, sp. n.

♂. Size rather small for the genus, just a little larger than that of *A amarensis* Chopard.

Head distinctly broader, than pronotum, though not as broad comparatively, as in *campestris* L., in profile very little prominent before eyes. Face in its lower part slightly impressed, or rather inclined, forming a very obtuse, but distinct, angle with clypeus; the latter is also subangularly prominent in its middle, if seen in profile; two scarcely perceptible impressions run obliquely from base of antennae towards the middle ocellus, not reaching the latter. Pronotum not much broader than long, equally broad throughout; fore margin slightly excavate; hind margin straight; a feeble median impressed line not

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eaching the hind margin; lateral lobes gradually widened anteriorly; their hind margin forming an obliquely rotundate line with lower margin; fore angle about 90°, rounded. Elytra not reaching the apex of abdomen; tympanal area much broader, than long; four oblique veins, the first of which is but feebly developed; speculum rotundato—rhomboidal, with transverse vein curved; marginal field with 5 branches of radial vein and four oblique wings. Wings undeveloped. Hind tibiae rather inflated on the upper side, just beyond the base; both upper margins in apical half sharp; five outer spines, the first of which is about half of the second and each of the rest slightly longer than its preceding; four inner spines thick, distinctly compressed laterally, with sharply attenuate feebly sinuate tips; first inner spine as long as the last of outer spines; three others a little longer; inner upper spur not much longer than the inner apical spine, slightly longer than a half of metatarsus, rather thick and compressed, feebly sinuate; lower inner spur only a little shorter than the upper one and subequal to inner apical spine; metatarsus thick; its upper inner margin rounded, while the upper outer margin is sharp and armed with four sharp spines; inner apical spur of metatarsus thick, compressed, subequal to one-half of second tarsal joint.

Black, slightly shining, entirely non-pubescent. Head and pronotum very finely rugulose. Mandibulae reddish-brown. Eyes and ocelli buff. Elytra dark-brown dorsally and black laterally, Hind femora reddish-brown at the base.

Length of body	20 mm.
Width of head	6, 5
,, pronotum	6
Length of pronotum	45
,, elytra	11, 5
,, hind femur	9
,, ,, tibia	6, 5
,, metatarsus	3
,, ,, tarsus	5, 5

3 ♂ ♂ (type and two paratypes) taken at Susa, Persian Chaldea, 60mt. above sea-level, by J. deMorgan's Expedition, 1904 (Paris Museum; one of paratypes in the British Museum).

This new species belongs to small representatives of the genus and is most nearly related to *A. amarensis*, Chopard, recently described from Mesopotamia but differs from it in the shape of head, clypeus and pronotum, in the more heavy armure of hind tibiae, as well as in relative dimensions of certain spines and spurs of the latter. In its habitus, *A. chaldea* reminds more of *A. campestris* L., while *A. amarensis* is a diminutive form of the type of *bimaculata*, De Geer.

63. GRYLLUS TARTARUS OBSCURUS Uvarov.*—Syria, Aleppo, iv-vii. 19, F. C. Aldous (British Museum).

64. GRYLLUS DOMESTICUS *L.*—Mohammerah, Persian Gulf, iii-iv. 17, R. C. Mabbs, 1 ♂ (British Museum).

65. GRYLLUS DESERTUS Pall.—Syria, Aleppo, F.G. Aldous (British Museum).

66. GRYLLOTALPA GRYLLOTALPA L.—Mesopotamia. Basrah, 27, v. 16, F. Wall (Bombay Society); River Karun, Mohammerah, Persian Gulf, iii-iv, 1917. R. C. Mabbs (British Museum).

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* Entom Month Magaz. 921, Vol. vii. p. 50.

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THE IDENTIFICATION OF INDIAN BUTTERFLIES.

By

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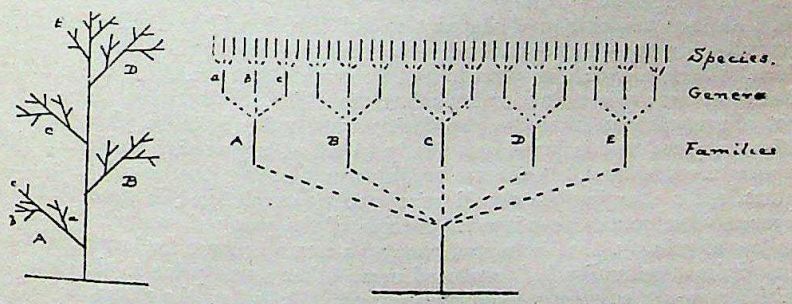
(*With 2 text figures.*)

1. In a former paper, entitled "Butterfly collecting in India," I have described briefly the characteristics of Indian butterflies and how to catch and preserve them. The object of the present article is to explain in simple language how butterflies are to be identified. There are several means of doing this. Perhaps the simplest is to get an expert to do it for one; another by comparison with Museum collections or coloured diagrams and lastly by worrying them out with a text book, such as Bingham's or De Niceville's. Museums and coloured diagrams are inaccessible to the majority of collectors except at rare intervals. Experts are few and far between and often somewhat unsatisfactory, so that the only thing remaining to be done is to work with a text book, which method, I may add is the most satisfactory in the long run. I would warn the reader that the identification of the 1,500 odd butterflies to be obtained in the Indian Empire is no easy matter even for the Museum expert and, unless the subject is studied in a methodical manner, the results are likely to be most inaccurate. Still do not be dismayed; except perhaps for the Blues and Skippers, the names of the butterflies, that are ordinarily to be met with, can be picked up pretty quickly, while the rarer or more obscure species can be put aside until a museum can be visited or an expert consulted.

2. As a prelude to identification it is necessary to understand the system of classification in general use. Now the object of classification is to arrange the specimens being classified in the most convenient manner possible for reference. With the various species belonging to the Animal and Vegetable Kingdoms the accepted desideratum is to follow what is called the natural order of evolution, the lowly bacteria being at the beginning of the list and man, in the opinion of himself, at the end.



The system of evolution may be compared to a tree. Consider the butterflies as represented by such a tree, which has sprung in the distant past from some older tree and so on from the earliest forms of life. Imagine our tree to be composed of a number of branches, from each of which has sprung a number of branchlets and from each of which again there have grown a number of twigs. The twigs represent the various species of butterflies and the problem is to arrange them in the best order possible. The correct solution of the problem is to take the lowest branch and to lay it on the ground; on its right is placed the next branch and so on to the last or topmost; the branchlets are then stripped off and laid above each branch in the same order

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finally the twigs are placed over the branchlets. Thus we manage to arrange the twigs or species in a reasonable order. It seems very easy, but unfortunately all that is left of our tree, which has been growing for millions of years, are just a few of the twigs. In some of the other branches of Natural History the Geologist can help the Zoologist to reconstruct their trees by means of fossils, but, as may very well be imagined, he can give us no assistance worth the name with our tree. Thus it may be seen that the problem of butterfly classification is extraordinarily difficult, since all we have to go upon is the study of present day conditions, our knowledge of which may be said to have attained respectable dimensions since the days of the pioneer Linnaeus at the end of the eigteenth century, but, as stated in my former paper, far more remains to be done especially in India.

3. The species is the basis of classification, but what constitutes a species is not so easy to define. Bingham in his volumes in the Fauna of India Series on the butterflies discarded the word as it was so open to misconception and used the word "form" instead. I think it is now generally accepted that, when two so-called forms fly together and do not interbreed, they are to be regarded as species; where they do not fly together and present well defined differences, it is a matter of opinion whether they are to be regarded as species or geographical races; usually if they are structurally similar and of similar habits, it is probably preferable to regard the two forms as races, otherwise they should be treated as species. A number of allied species are grouped for the sake of convenience into what is called a genus. Usually butterflies that differ in structure are placed in separate genera, but no hard and fast rule can be laid down, since certain obviously closely allied species differ materially from each other in this respect, as also do rarely individuals of the same species, while cases are by no means unknown where the structure of the wings on one side differs from that on the other side. Some Naturalists divide genera into sub-genera, but except perhaps in the case of some of the larger and more unwieldy genera this elaboration is undesirable. Genera are further grouped into sub-families and families. A reference to the diagram in paragraph 2 will indicate how the families, genera and species correspond to the branches, branchlets and twigs of the butterfly tree.

4. Without the history of the past to aid him, it will be realised that the Naturalist is groping in the dark when he tries to discover the natural order in which butterflies should be placed. All he can do is to examine the features of each species; to ascertain and tabulate the differences between them in respect of every known character; to decide what value is to be placed on the differences that he has found and finally to adopt a grouping and order that appears most natural. Amateurs are always blaming the so-called cabinet naturalist for changing the classification and nomenclature; I share their annoyance when some delver into the records of the past enforces what is called the law of priority, that is to say, changes a name because he has found that some defunct naturalist had produced some other name prior to the date on which the one in current use had been coined. But when the change is necessitated by a well founded advance in knowledge, the objection is a foolish one. The essential point to bear in mind is that no hard and fast rules can be laid down for the definition of a species, genus, or family or for the value of any particular feature; again and again a character that has been considered above reproach for defining species, etc., has turned out to be a snare and a delusion. The consensus of opinion of the best naturalists of the day is the only guiding principle that can be followed. I am afraid that the leading experts often differ a good deal, but at least the main principles of butterfly classification have now been settled.

5. Having outlined the principles of the system of classification in vogue and its limitations, it is now necessary to consider the various characters on

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which it is based and to explain in general terms the value that can be placed on each. Broadly the characters may be divided into two main groups, those appertaining to the early stages and those to the butterfly itself. I will pass briefly over the features that concern the early stages. My reasons are firstly that a knowledge of them is of no use to the amateur who is trying to identify his captures and secondly that they have been very fully described by Mr. Bell in his articles on the "Common Butterflies of the Plains" now being published in the journal; for purposes of classification their importance is paramount. The principal characters are the egg, its shape, size, its delicate ribs and whether laid singly or in clutches; the caterpillar or larva at birth and when full grown, its shape and clothing, whether of hairs, spines or tentacles, etc., the plant it feeds on and whether its habits are gregarious or not; the chrysalis or pupa, its shape and mode of attachment. Let us pass on to the perfect insect or imago as it is technically called. The features to be studied are firstly those pertaining to the body, *i.e.*, the legs, eyes, antennae, palpi and genitalia; secondly those pertaining to the wing, *i.e.*, the shape, venation, cilia, markings and secondary sexual characters. I will not discuss further the genitalia, which are to be found at the end of the body or abdomen, since their examination is beyond the beginner; their study is still incomplete, but since it was commenced, a number of changes have had to be made in the arrangement of various species and genera. The remaining features should be studied carefully by the beginner: the procedure is perfectly simple, if the spirit is willing. To follow the descriptions it is as well to have at hand a freshly killed butterfly of comparatively large size so that it does not dry quickly and which has not been mauled about too much during the process of killing. A good hand lens is a necessity and to make the veins of the wings easily visible apply pure petrol liberally by means of an ordinary fine paint brush.

6. A butterfly has six legs springing from the part of the body known as the thorax and each leg consists of four parts; the coxa or hip next the body, usually rather difficult to see properly; the femur or thigh next to the coxa, usually long and directed upwards; the tibia or shank, also usually long and directed downwards; the tarsus, which is in continuation of and in line with the tibia, is composed of a number of small joints and ends in a single or double pair of claws. The tibia of the foreleg sometimes bears a central spur and on the hind leg it may be furnished with one or two pairs of movable spines. In many butterflies the forelegs are atrophied and unfitted for walking, sometimes, more particularly in the male, appearing as a brush pressed up against the body. Sometimes the legs are curiously swollen, often more or less hairy, while in some species of skippers the male has a prominent tuft of hair on each of the fore coxae or hind tibiae. The differences between the legs have proved of the very greatest importance in defining families and genera, perhaps more so than any other feature. In certain families the sex can be at once indicated by a glance at the forelegs.

7. The eyes of butterflies are composed of an innumerable number of minute faces; they may be absolutely smooth or covered with hairs, the density and length of which varies with the species. Whether the eyes are smooth or hairy (ciliated) serves very often as a useful and easily recognised character for separating genera. Usually the eyes are black or shining golden brown, but in some of the skippers they are blood red.

8. The antennae are the long feelers that spring from the forehead of a butterfly between the eyes. Usually they are close together at their bases but in the skippers they are wide apart. They may be smooth or scaled, plain or chequered, or smeared with white or ochreous colouring. Their relative length is an important matter, while the shape of the club at the end of the antenna is even more important. In some species, blues principally, there is no club at all (filiform); in others there is just a perceptible thickening at the end (incrassate),

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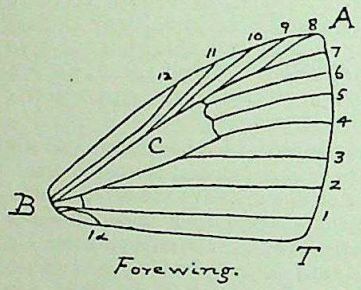
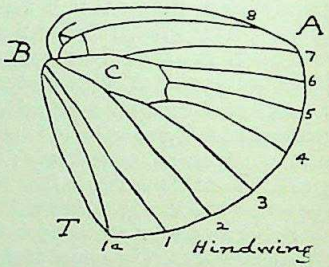
usually there is a well shaped club (clavate or pyriform); the club may be hollowed out below (excavate); in many skippers there is a long filiform end to the club, which is bent over like a hook. The colour of the club varies and there may be a white band below it. The variations in the antennae are often found to be useful in defining genera.

9. The palpi are comparatively large processes, one on either side of the head springing from the edges of the mouth and curving forwards in front of the face and eyes; between the palpi is protruded the proboscis. Each of the palpi consists of three joints, of which the first, nearest to the body, is hardly distinguishable from the stout second joint; the third joint is much narrower and varies very considerably in different species; in some it is needle like; in others entirely concealed in the second joint; sometimes very long and stout; sometimes the third joint is what is known as porrect or extended forwards horizontally or it may be vertical, known as erect. The clothing of the palpi often furnishes a useful means of separating genera; it may be hairy, bristly (or setose) or scaly.

10. The beginner should master as soon as he can the venation (or neuration), that is to say, the arrangement of the veins (or ribs, nervures or nervules) that support the wing membrane and the nomenclature that is employed to describe them. The majority of the genera are based upon venation differences.





B is the "Base" of the wing next the body.

A is the "Apex" and T the "Tornus" or anal angle.

The margin of the wing from B to A is known as the "Costa" or costal margin; from A to T as the "Termen" or outer margin; from B to T as the "Dorsum" or inner margin.

C is an enclosed area known as the "Cell," from which it will be seen that most of the veins spring or have their origin.

The veins are numbered as shown in the diagram.

The vein bordering the upper edge of the cell from the base to the origin of vein 7 is called the subcostal vein (or scv for short); that bordering the lower edge of the cell from the base to vein 4 is the median vein (mv); the veins at the end of the cell between veins 4 and 7 are the discocellulars (dcv); between 7 and 6 it is the upper dcv, between 6 and 5 the middle dcv and between 5 and 4 the lower dcv; the middle and lower dcvs may sometimes be absent.

There are normally 12 veins on the forewing (F or FW for short), but vein 8 and sometimes vein 9 also may be missing. In the majority of butterflies vein 8 and 9 and sometimes vein 10, rarely vein 6 as well, emanate from vein 7, but in the skippers all the veins spring from the cell. In some groups vein 1 (v1 for short) is forked at the base; in others there is a small vein between v1 and the mv; v1a is only present in one group. The veins along the costa are sometimes bent towards each other, occasionally touching and more rarely

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completely coalesced or what is called anastomosed. In one group the basal portion of v12, often also of the scv and even of the mv is swollen.

In the hindwing (H or HW) there are only 8 veins, but v1a is present in the majority of species, as is also the short curved spur near the base of v8, known as the precostal vein (pcv). In some species there is a small precostal cell formed either by a small vein between v8 and the scv or v8 and the pcv. Normally all the veins from 2 to 8 spring from the cell, but sometimes vs 3 and 4 may be forked beyond the cell. The middle and lower dcvs as well as v5 may be absent or only faintly indicated.

The secondary sexual characters often cause curious distortions or swellings of the veins.

In the older text books v1 is called the submedian, vs 2, 3 and 4 the first, second and third medians; vs 5 and 6 F and v5 H the discoidal veins, v5 also being known as the radial; vs 7 to 11 F and 6, 7 H the subcostals; v12 F and v8 H the costal. The dcv is sometimes called the transverse vein.

Differences of venation are of variable value in different groups; sometimes a difference will separate whole sub-families, while sometimes well marked differences are to be found between the sexes of the same species. As a rule the differences observable on the forewing are more important than those of the hindwing.

11. The shape of the wings is often an important consideration, though here again the value of the feature is variable; sometimes the seasonal and sexual differences are remarkable. The presence or absence of one or more tails (caudate) towards the tornus of the hindwing is usually important, though there are species, which may or may not have a tail. The tails may be very fine (filiform) or stout and fringed like the rest of the wing (ciliate). The costa may be straight or more or less highly arched and sometimes on the fore wing it is serrate or furnished with teeth like a saw, easily felt by drawing the tip of the finger along it from the tip towards the base; on the hind wing the costa is occasionally concave. The apex may be rounded, sharply pointed or produced in comparison with the rest of the wing; occasionally it is produced and the termen is concave below, when it is termed falcate. The termen or outer margin may be sinuate or wavy, straight, convex or somewhat rarely concave; crenulate or dentate, when produced at the end of each vein and concave between the veins. The dorsum may be straight or concave; sometimes in the males it is highly convex. The tornus of the hindwing is often more or less produced, but more usually it is rounded; it may be angled sharply; sometimes, especially in the blues, it is furnished with a more or less prominent lobe.

12. The cilia are the fringes, composed of two or three layers of scales that are to be found bordering the termens of the wings. They may be cinereous (ashy), white, yellow or brown; or they may be more or less chequered. Their length is variable and often more pronounced at the tornus of the hind wing, where also they may be differently coloured.

13. The differences between the markings on the wings are used to separate species, but here again a word of caution is necessary; the seasonal or sexual differences are often most extraordinary; development under identical conditons often causes the species of widely separated genera or even families to look alike and an examination of the structure is necessary. In some genera the species are so alike that they can only be separated by an examination of the genitalia or of the secondary sexual characters. The variation between the individuals of the same species is often considerable and there is a tendency to the obsolescence of the markings, while so-called sports or mutations are occasionally to be met with. There are quite a number of skippers belonging to different genera which are plain brown insects bearing no markings whatsoever. A few technical terms are used when describing a butterfly, which the beginner should master.

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The interspaces between the veins are numbered after the vein next below; thus space 1 is the interspace between veins 1 and 2; the space before vein 1 is 1a and that before vein 1a, when present, is called 1b. Markings parallel to the veins are called longitudinal and those at right angles to them transverse. Markings internal to the centre of the cell are basal; those about a line through the centre of the cell are subbasal; those about a line through the end of the cell are central. The area between the end of the cell and the termen is known as the disc and the markings about the centre of the disc are discal; those before the centre are prediscal and those after the centre are postdiscal. Markings along the termen are terminal or marginal and those just before the termen are subterminal or submarginal. Markings along the costa are costal, those about the apex are apical; those about the tornus are tornal or anal and those about the dorsum are dorsal. The names subapical, etc., are used for markings near the apex, etc.

The colour of the ground generally and of the markings is naturally a matter of importance and is often very difficult to describe in words. Often it is iridescent, presenting a different shade according to the light. Amongst the blues, it is quite impossible to define the exact shade.

The shape of the markings have to be defined. A spot may be annular, if it is just a ring enclosing the ground colour; reniform if it is kidney shaped; the words quadrate, rhomboidal, oval, elongate require no definition. If there is an eye in the centre of a spot, it is called an ocellus and the eye may be furnished with an iris; if there are two eyes the ocellus is called geminate. A band or fascia may be continuous or broken, straight or curved, regular or irregular; if broken or irregular, it is important to note at which vein or space this occurs. A band consisting of more or less conjoined spots is called macular and, if the spots are annular, it is catenulated. A line may be sinuous, or if, as is often the case, it is composed of conjoined crescents, it is lunulate or lunular. Fine lines are called strigae and, if the wing or a portion thereof is covered with fine lines, it is described as striated.

14. The secondary sexual characters to be found in the males of certain species are of various types. Many authors separate off genera on account of differences in these characters, but unless a convenient group is formed thereby, the practice is to be deprecated. The features to be found are tufts of hair on the wings, legs or at the end of the abdomen, which may be recumbent or erectile; brands on the wings in various positions, which may consist of narrow stigmas or of large circular or oval patches and which may be covered with tufts of hair; swollen or distorted veins; pouches on the wings, pendulous or flat; the dorsum of the forewing bowed; nacreous or scale-less patches about the dorsum on the unf or the costa on the uph; pencils of hair that can be extended from the end of the abdomen. Except in a few isolated cases the females are devoid of these characters; in two genera there is a corneous pouch, the shape of which varies with the species, at the end of the abdomen; and in the Blues there is a species with a peculiar tuft of close set fine hairs at the end of the abdomen.

15. The description of a genus comprises the following in the order given:

Forewing (F), shape and venation.
Hindwing (H), do.
Body, Legs, Antennae, Palpi, Eyes.

A note showing how the sexes differ and how the genus differs from its allies.

For a species the description should be given in the following sequence:

Above, general colouring; cilia.
Upperside forewing (upf), shape and markings.
Upperside hindwing (uph), do.
Below, general colouring; cilia.
Underside forewing (unf), shape and markings.

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Underside hindwing (unh), shape and makings.
Colour of body, legs, antennae and palpi.

The male (♂) is described first and then the female (♀). Where seasonal variation occurs, the wet season form (wsf) is followed by the dry season form (dsf). Individual and geographical variation is then described, ending with a comparison with its allies and a note on its habits, time of appearance, etc. At the end of the description the expanse should be stated, preferably in millimetres, the expanse of a butterfly is measured from the centre of the thorax to the extreme tip of the forewing and the figure so obtained is doubled.

A butterfly scientifically bears two names, that of the genus followed by that of the species, thus *Papilio polytes*; if the individual belongs to a particular geographical race a third name is added, thus *Papilio polytes romulus*, the first named race (name type or nymotypical form) being *Papilio polytes polytes*. Where a variety has to be specified, a further name is added with the prefix var. or v., and if pertaining to one sex only, the sex sign is also given, thus *Papilio polytes romulus* ♂ v. *cyrus*. After the last name it is usual to add the abbreviated name of the describer, thus *Papilio polytes*, L. (=Linnaeus). Some authors assign latin names to seasonal forms, but the suffixes wsf. and dsf. seem more suitable. Casual varieties and aberrations have been named, but the practice is undesirable, while the naming of slight varieties leads to endless confusion. Dimorphic forms and strongly marked varieties of reasonably frequent occurrence alone seem to be worthy of names as varieties.

16. The foregoing sketch will, I hope, enable the beginner to follow the text books on Indian butterflies, viz.—

The Butterflies of India, Burma and Ceylon ; by Marshall and De Nicèville.
Lepidoptera Indica ; by Moore and Swinhoe.
Butterflies, Fauna of India series, by Bingham.
The Macro-lepidoptera of the World ; by Seitz ; the Indo-Malayan section by Fruhstorfer and Jordan.

DeNicéville and Bingham give full descriptions of each species but very few illustrations ; they both give keys, whereby the patient student can work out the identification of his captures. Moore gives complete descriptions and a coloured figure of every insect, but no keys. Fruhstorfer gives the briefest of brief descriptions, no keys, but nearly every species is illustrated. It will be found that the nomenclature adopted by the above authors differs very materially, partly because their ideas on classification differed, partly because of the progress of the knowledge in the interval and partly because errors in names required rectifying. When somebody catches a butterfly that he cannot identify and thinks rightly or wrongly that he has a species no one has given a name to, if he considers he is competent enough to do so, he describes it and gives it a name. He is supposed to describe a particular specimen, which is designated the type and if he would only lodge the type in the British or other first class museum, all would be well, since any mistakes he may have made can be rectified in due course. But if, as is so often the case, he keeps the type in his own collection, it eventually gets lost and then the trouble begins ; reams may have to be written as to what he really meant, while others catching the same insect may describe it as new. If perchance a name has been used for a species that had already been used in the same genus, then by the rules of priority the name cannot stand and another name has to be coined, but, if later on the species is put into another genus, the old name has to be dug out ; and so the game goes on. In the case of genera the rule is that you must not use a name that has been used for a genus already in any of the realms of Zoology, so that the game of changing names is almost as exciting as in the case of species. Owing to our nation not being the only pebble on the beach, the institution of a strict co-ordinating authority is hopeless, though efforts have been made in that direc-

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tion with some success. Discarded names are called synonyms and many species have collected quite a number of them.

17. In order to further the study of the Indian butterflies and to popularise it, what appears to be needed is a cheap publication, whereby identification may be effected with reasonable facility. Full descriptions bore the ordinary amateur, while the really earnest student can refer to the text books; good keys giving the main differences are more acceptable to the majority. Coloured plates are very expensive, but well executed photographs carry one a long way and have the merit of being accurate, which is more than can be said always of hand coloured plates. I propose to follow up the introduction to butterfly catching in India contained in my previous article and the present one by a series of keys accompanied by about thirty plates, containing sufficient illustrations to enable a beginner to spot the genus to which a particular insect belongs, after which the key will enable him to discover the species. The photographs are being taken by Mr. Albert Jeakins of Simla, who being a Naturalist as well as a photographer, is taking the very greatest pains in carrying out the work. An attempt has been made to give trivial names to the species, not the races, since many a beginner will not face the latin names; I have made an attempt to use the names prevailing at schools in the Hills; Mr. O. C. Ollenbach has assisted me in selecting the names. The work, which has been carried out in my leisure moments, will not be quite up to the standard it might have reached had I had more time to devote to it and the opportunity of referring to a museum collection or library. It will, I hope, serve a useful purpose and later on it may be possible to produce an improved edition in book form, embodying any suggestions that members may care to make.

18. In order to shorten the work, full use has been made of abbreviations. Where I cannot personally vouch for a locality, I have added the authority in brackets. The families are lettered A, B, etc.; genera are numbered serially within the family and species serially within the genus; a particular butterfly can then be referred to as say B14-3. It will be seen that at the beginning of each paragraph in the keys there is a number followed by a number in brackets (in the families key letters in place of numbers), thus 1a (6a), if the description under 1a corresponds, pass on to 1b, if it fails go on to the number in brackets 6a. The reason for using the order 1a, 1b—1 is to preserve the numbering of the species or genus as the case may be, which always follows a number without the small letter suffix. Geographical races are distinguished by Greek letters. No synonyms will be given. I follow the order which appears to me best and most up-to-date. Small print notes will be found at the end of each section explaining any departures from the hitherto accepted practice, notes on any new genera, species or races, etc.; these notes are intended for the expert and the amateur need not bother to read them; they will be made as short as possible. Do not expect perfection; owing to the variation that occurs, the construction of foolproof keys is impossible; remember too that the aim of the work is cheapness and that it has been executed in the spare time of an overworked official.

Keys to Indian Butterflies.

Families.

Aa (I). F one or more veins emanate from v7. Antennae approximate at the base. Hind tibiae with only one pair of spurs.

Ab (H). H with precostal vein (except a few Pierid æ).

Ac (Ca). Forelegs fully developed in both sexes.

A (B). H v1a absent (present in all other families).

Papilionidæ. The Swallowtails.

B (A). H v1a present.

Pieridæ. The Whites.

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Ca (Ac). Forelegs not perfect in both sexes.
Cb (G). Forelegs imperfect in both sexes (except in two genera).
Cc (Ea). F and H cells closed, dcvs present.
C (D). F vi runs into the mv at the base.

Danaidæ. The Danaids.

D (C). Fvi runs into base free of the mv.

Satyridæ. The Browns.

Ea (Cc). H cell open, dcvs absent (slenderly closed in a few cases.)
E (F). Palpi small, narrow and sharp in front

Amathusiidæ. The Amathusiids.

F (E). Palpi large, broad, rounded in front. F cell usually open.

Nymphalidæ. The Nymphalids.

G (Cb). Forelegs imperfect and brush-like in ♂ ; developed for walking in the ♀ .

Erycinidæ. The Erycinids.

H (Ab). H no precostal vein. Forelegs perfect.

Lycaenidæ. The Blues.

I (Aa). F all veins from the cell or base. Antennae wide apart at the base and often with a hooked club. All legs perfect.

Hesperiidæ. The Skippers.

Notes.—I have followed Seitz in adopting the above order and names; English authors place the Papilionidæ and Pieridæ after the Erycinidæ; treat the Danaidæ, Satyridæ, Amathusiidæ and Nymphalidæ as subfamilies of one family, the Nymphalidæ ; call the Amathusiidæ, the Morphidæ and the Erycinidæ, the Nemeobidæ or Riodinidæ. The Hesperiidæ are sometimes treated as a separate suborder under the name Grypocera, the remainder of the Butterflies being the Rhopalocera.

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EGRET FARMING IN SIND.

BY

CAPT. C. E. BENSON, D.S.O.

(*With 2 plates*)

Whilst spending a fortnight duck shooting in Sind, I took the opportunity of visiting one or two Egret farms. My object was to try and form some sort of opinion as to whether the method of farming, as practised by the villagers, was satisfactory or not.

There are many difficulties which stand in the way of an individual who attempts to collect true information on a subject that closely concerns the pockets of the people from whom he is trying to collect that information. Not the least of these is, that one is usually mistaken for what one is not. As an instance of this, at Changro, in the Kambar district, near Larkana,—a busy centre of Egret farming,—I was mistaken for a Government of India official expressly sent down from Delhi, for the object of finding some just cause for levying an increased tax on Egret feathers. No assurances on my part could remove this idea from the minds of the villagers. The information obtained there was consequently entirely derived from personal observation, and any other facts, for the truth of which I had to rely on the word of the villagers themselves, were not probably strictly within the bounds of accuracy.

Again, one of the most important features of Egret farming, is the actual method of plucking; for it is in doing this that the greatest cruelty can be practised.

If one cannot witness the actual operation of plucking, the next best thing is to be able to see the bird immediately afterwards. This I was able to do at an Egret farm on the Munnchur Lake near Boubak Road. The Mahanas on the Munnchur themselves proffered a great deal more information than any that I had been able to collect either in the Larkana or in the Kambar district—information that I was able to verify by personal observation. They were no strangers to me and consequently had no suspicions of my having any underlying motive for my enquiries.

Here also I was lucky enough to meet an Excise Officer who had himself countless times witnessed the capture, breeding, transport and plucking of the birds, and consequently was able to add invaluable and reliable information to that which I had already obtained.

In the following table I have endeavoured to collate all the facts of importance, accuracy and interest obtained from the sources above mentioned, avoiding as far as possible any statements which I have not been able to prove either by personal observation or through reliable information.

Though there are many Egret Farms in Sind and I have had the opportunity of visiting only a very few of them, I am nevertheless convinced that the methods practised in one are in the main those practised throughout the whole of that country.

Enclosures for Birds.

1. The size of the average enclosure is about 40 feet long, 20 broad and 5 high.
2. The walls and roof are constructed of poles and matting, or of woven reeds.
3. The floor is of hard mud and the general condition is extremely clean.
4. The number of birds to each enclosure varies from 80 to 120.
5. In some places birds are marked according to broods or enclosures by dyeing the breast feathers.
6. No perches are provided for the birds.

Food and Water.

1. The food supplied consists of un-chopped small fry.

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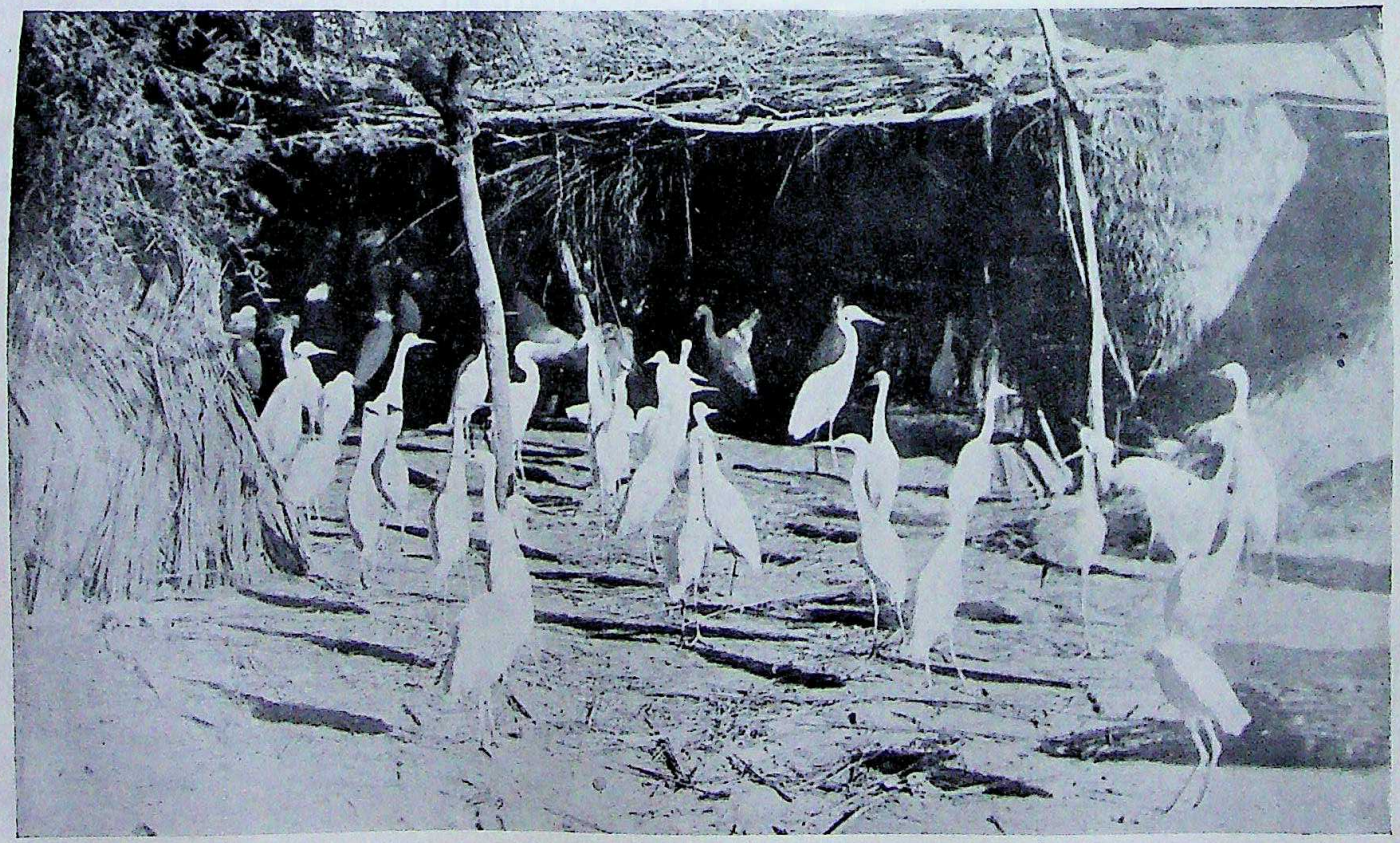
EGRET FARMING IN SIND.



ONE OF THE ENCLOSURES IN A SIND EGRET FARM.

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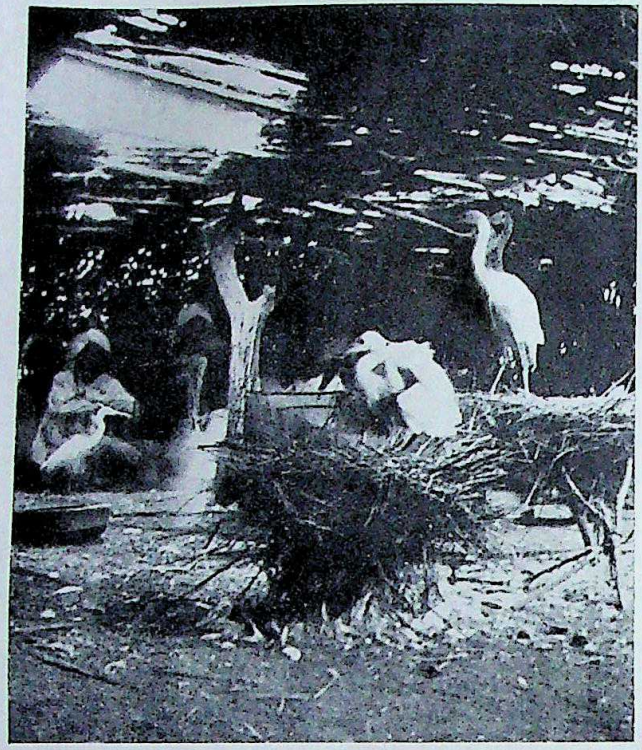
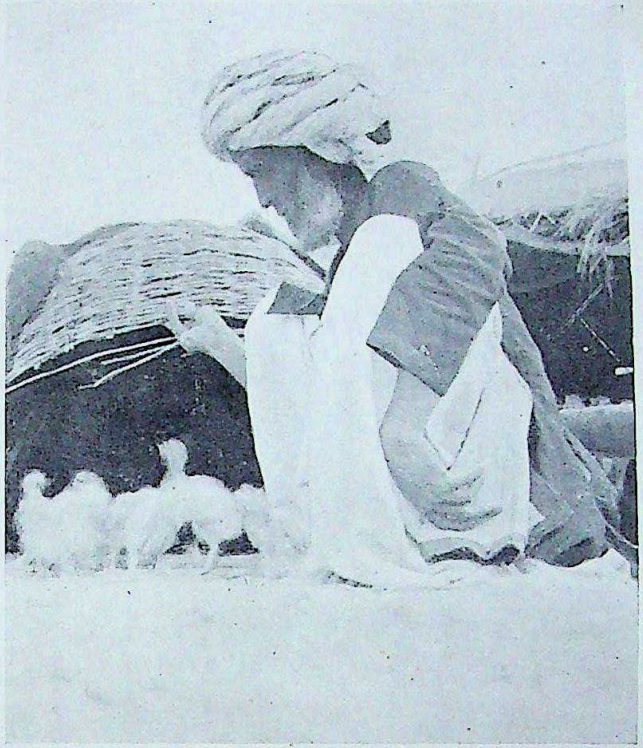
EGRET FARMING IN SIND.



Nesting Birds.



Additions to the Family.

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2. In all the places visited the supply of these fry was easily obtainable by netting in the neighbouring dhands and they were all fresh and clean.
3. The quantity given per bird per day was sufficient—about 1 lb. a day.
4. Water is supplied in earthenware bowls which are left lying on the ground and of which there are large numbers in each enclosure.
5. This water is obtained either from the well in the village itself, as at Changro where the villagers drink the same water as that supplied to the birds, or from the neighbouring dhand, as on the Munnchur.

N.B.—As the condition of the feathers of the bird is improved by a good supply of both fresh food and water, it is certainly not in the interests of the villagers to in any way stint them of these necessities. In all the enclosures I visited the birds appeared well fed and not in the least hungry, and there was never any visible sign of any shortage of either food or drink, both of which were lying about in every enclosure in large quantities.

Mutilation.

1. No blind Egrets were seen.
2. The terminal joint of the wing of every bird is amputated.
3. Birds are never tethered in the enclosure.
4. Whenever the birds are moved, either by road or rail, the eyelids are sown up. The method adopted is as follows:—
   The lower lid of each eye is pierced by a fine needle and a piece of very fine cotton thread is drawn through. The two pieces of cotton are then tied over the head of the bird, thus causing the lower eyelid to be drawn up over the upper eyelid.

N.B.—With the exception of the Egret farm on the Munnchur very little transportation takes place. In fact the transportation of the birds is almost entirely confined to those times when the newly captured Egrets are brought by rail from the place where they have been originally caught to the farm in Sind which has bought them. As most of the farming is carried on by breeding, there is very little transportation taking place and therefore very little suturing.

But on the Munnchur it is quite different. Here the Mahanas are compelled by floods to move their huts twice a year—once at the beginning of the rains from the borders of the lake to Bubak village, and again back again at the end of the rains. Hence the birds have their eyelids sown up twice a year.

I carefully examined over 50 birds on the Munnchur Lake which had undergone the operation of suturing, but never discovered any visible ill affects caused thereby. But it must be remembered that as I visited the farm in February, no birds had been sutured for the last four or five months.

Extraction of Plumes.

1. All the dorsal plumes of *H. garzetta* are plucked once every three months, just before moulting would naturally take place.
2. The plumes are not plucked one by one, but all together, one man holding the bird while the other plucks.
3. The feathers are held in the centre and are jerked out.
4. The backs of the birds immediately after plucking show considerable laceration and a good deal of blood is drawn during the process.
5. The occipital plumes of *H. garzetta* are not plucked.

N.B.—Curiously enough the bird, during the actual plucking, does not show any obvious signs of pain. There are no bad after effects that I could see. The bird does not sulk but continues, on release, to walk about and feed as if nothing had occurred. What pain there may be would appear to be purely temporary. But from the con-

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dition of the backs of the birds which I was able to examine carefully on the Munnchur Lake, I am convinced that the pain inflicted by plucking, as the villagers do it, temporary as it may be, is certainly *very* considerable. It is also hard to believe that there are no permanent after effects, though I never found a single trace of one. The method they adopt however for extracting the feathers in Sind is undoubtedly disgraceful and all the pain inflicted could certainly be avoided.

Breeding and Treatment of Young.

1. When the nesting season approaches, in some cases old Egret nests are provided; in others dried sticks and grass are given the birds with which to make their own nests.
2. Sufficient quantities of nests or of other materials are provided to allow for every pair of birds who wish to nest.
3. No perches are provided and the nest has to be made on the ground.
4. The number of birds in each enclosure is not reduced when the nesting season approaches which leads to over-crowding.
5. The young birds are not removed from the parent birds, nor are they fed in any separate way or on any other diet.
6. The parent birds and their young are placed in separate enclosures and there is no interference with the natural bringing up of the young birds.
7. On the young birds being fledged the terminal joint of the wing is cut and the new brood is then placed in a fresh enclosure, the parent birds being returned to their original enclosure.

N.B.—On the Munnchur the parent birds are allowed to wander free with their young outside the enclosure. But on the young becoming fledged the same procedure is followed as above.

Capture of Wild Birds.

1. Comparatively speaking few wild birds are captured, and the stock is almost entirely renewed by breeding.
2. In the Kambar district the villagers say that they import their new birds from the Punjab and that no trapping of any sort takes place in their district.

N.B.—This is probably not true, but I could obtain little information about this actual fact.

3. On the Munnchur, when wild birds are required, they are captured as follows :—

   A one inch mesh net is staked out on the ground when and where the Mahanas expect the wild birds to come. Round this net are placed stuffed decoys. When the wild bird alights he gets his feet entangled in the mesh of the net and is then easily captured. The wing is then cut and the birds are put into an enclosure.
4. There seems to be no special method of taming the newly captured birds.
5. The method of starving wild birds as a means of taming them is not employed.

N.B.—I myself know of one wild bird which was captured, slightly hurt, by a private individual. On being cured, which took only a few days, it was handed over to the Mahanas on the Munnchur who placed it straight into an enclosure with the other already tame birds.

Transportation of Birds.

1. The cages employed for transportation, either by rail or otherwise, are: Size :—3 feet by 3 by 3.

   From 15 to 20 birds are placed in these cages.

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EGRET FARMING IN INDIA

BY

C. C. Chevenix Trench, I.C.S.

Thanks to painstaking enquiry and persistent re-iteration of the truth by observers in India, there is now no shadow of excuse for any intelligent inhabitant of the United Kingdom to doubt the existence, on a fairly extensive scale, of Egret farms in India, where the birds are kept in conditions favourable to their increase and whence the plumes are exported without the slightest danger to the life of the birds. The charges of 'bribed by the trade' so recklessly levelled by the home-keeping sentimentalist are now a matter of amused and contemptuous recollection. I suggest that the time has come for a brief survey of the position of Egrets in India and for determining the lines along which the efforts of the Society in their behalf should be directed. The following observations are, therefore, submitted, in all diffidence.

(*a*) Egrets (Lesser and Cattle) are at present extraordinarily plentiful nearly all over India. Their plumes are so valuable and so easily smuggled out of the country, that no amount of prohibitive, but unintelligent legislation, will prevent the export trade in *aigrettes*, which continues to-day as it has done in the past, in spite of the Plumage Act.

(*b*) What has saved the birds from partial or complete extermination in the past, is the ignorance, apathy and conservatism of the Indian, *and the Arms Act.*

(*c*) The ignorance,etc., is rapidly disappearing under economic pressure. (In November the Central Provinces are overrun by itinerant middle-men who buy up the plumes from petty local men, and either take them to "a gentleman" in Calcutta or hawk them about Indian cities for a price which, in my experience, ranges from 10 to 28 times their weight in silver). The Arms Act, under pressure of the Reforms, is being relaxed, Provincial Councils cannot for much longer withstand the clamour of the Agricultural classes (70 to 80 per cent. of the population) for unlimited gun licenses for protection of crops, and soon every peasant will, if he likes, possess a gas pipe gun.

(*d*) When both these tendencies come into full play, the extermination of the egret from India is, I consider, certain, and may take place in an astonishingly short time. Because the birds congregate in colonies when the plumes are at their best, and have a distinct tendency to locate their breeding colonies near or even in the heart of villages and towns. Thus they are accessible with no effort and can be killed with the minimum of expense. We have the example of the American Bison to warn us.

(*e*) In the competition between the gun-man and the egret farmer, for the supply of plumes, the latter will go to the wall, unless officially encouraged. No one who has watched the course of the times can doubt that it will soon be cheaper and easier to kill egrets than farm them, nor is there the faintest danger of interference by the local rural police, who, in the rainy, *i.e.*, the breeding season, are powerless.

(*f*) To save the egret the farming of the birds should be encouraged in every possible way, *and the export of farmed plumes permitted under license.*

(*g*) This will be the founding of a virtually new cottage industry in India of which the profits are likely to be very large. The industry can be managed at least as humanely as Ostrich farming. In parenthesis, had it not been for the farming of the ostrich, the geographical range of that

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bird would by this date, have undoubtedly been restricted to the least accessible parts of Africa and Asia.

(h) On economic as well as sentimental grounds, egret farms should be legalised and the present ill-considered prohibitive legislation which is leading to the extinction of the bird, altered at the next review of the Plumage Act Schedule. This can be done by influencing public opinion in Europe through the press and through leaders of Society. Photographs, propoganda, interviews, etc., are necessary.

In March last I had the honour of interviewing the then Secretary of State for India Mr. Montagu, on the subject. A keen, practical ornithologist himself he listened with the greatest sympathy and undertook to look into the matter again after consulting local Governments in India. But as he is no longer in office, without a fresh effort it is probable that little or nothing will be done.

The chief objection in official circles to the amendment of the Schedule in the direction suggested, appears to be the difficulty they anticipate, on the part of Customs Officers, of distinguishing between parcels of shot, *i.e.*, illicit plumes and farmed plumes. This is a bogey and any Revenue Collector through his staff of Patwaris, Talatis and other Revenue officials, can discover in a single season the number and localities of the protected Egret breeding colonies or Egret farms, in his district. He can also ascertain with equal ease the output in plumes almost to a tola, of each colony or farm. With little or no risk of gross error he will be in a position to 'certify' every consignment of plumes from his district. His certificate will accompany every parcel and state the weight of the parcel covered by it. All the customs authorities need do is to check the weight.

I mention 'colonies' as well as farms because though farming egrets has not yet spread to my own, the Central Provinces, in one district a breeding colony on a riverain island has been protected for 15 years past with great profit by a half-witted Mahomedan, who picks up and sells the moulted plumes which drop at the colony. In 1910 I found this man tending the fire he had lit round the root of the nesting tree to keep off the pythons. There were then about 60 couples breeding. Neighbouring landlords were shooting his birds and after giving him what protection a Settlement Officer could, I left the district in 1912. In 1920 I revisited the colony. It has spread to over 400 nests, and established a branch colony on the mainland. The watcher had become a man of substance, purchased land, married his nieces. He called the colony his village and climbed in and out of the nests without the birds appearing to notice his presence. Spoonbills, snakebirds, little green bitterns, cormorants and purple herons had also joined this happy little republic of 'Cloud-cuckoo town.' He sells his output yearly to a 'gentleman in Calcutta' for Rs. 6/- a tola. The moulted plumes from a colony in the compound of the Police station house in Raipur, C. P., used to be zealously collected and sold till the trees were felled a few years ago.

All the evidence shows that the rural Indian takes very kindly and spontaneously to egret protection and farming. With a little official encouragement, I am convinced that in a few years there would be thousands of farms and protected colonies scattered over the Peninsula and that public opinion would by then dispose of the murderous gun-man. The legislation now in force is an effectual barrier to the realization of this much-to-be desired ideal. Well may the Indian egrets pray for protection from their friends.

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ROUGH LIST AND NOTES ON THE BIRDS FOUND BREEDING IN THE GONDA DISTRICT, OUDH.

By

F. Field.

A short description of the physical features of the District will not be out of place. The District of Gonda lies in the north of Oudh, between the outer ranges of the Himalayas and the Ghagra river, which are its Northern and Southern boundaries, to the West is the Bahraich and East the Basti Districts. The District is one of the largest in Oudh, it comprises 2,809 square miles between Lat. 26° 46′ and 27° 50′ N. & Long. 81° 33′ & 82° 46′ E.

The District may be roughly divided into three classes of country. From the Nepal frontier, its Northern boundary is a belt of Government and Zemindari Forest, this belt is roughly from 5 to 10 or more miles in width ; below this is an open and low lying tract, chiefly under rice cultivation, termed *'tarai,'* subject to frequent floods, as innumerable torrents from the hills debouch into this part; this portion is drained by the Rapti river, which practically cuts the District in two.

South of the Rapti, the country is upland, planted over with numerous groves of Mango trees and others, and well cultivated. This upland forms a rather narrow belt, running diagonally across the District ; along this belt flows the Kuhany river, a deep, but sluggish stream, both banks being covered with forests and jungle. Below this high land comes a lower lying tract, rich soil and heavily cultivated with numerous groves of trees. This fertile land is watered by two deep, but sluggish winding rivers, Tehre and Sarjoo. These streams have in the course of ages shifted their beds repeatedly, leaving numerous large lakes and jheels, these lakes are sometimes clear, but usually covered with aquatic plants, wild rice and tall rushes, reeds, etc.

This great variety in the features of the District, giving tracts of dense forest, open plain, country covered by numerous groves of trees with rivers, lakes, marsh, etc., makes it an ideal country for variety of bird life from water birds to the submontane species.

Notes on nidification of Birds of the Gonda District.

No.	Scientific name.	English name.	Remarks.
4	Corvus macrorhynchus.	Jungle Crow ..	Very common, more so than *C. splendens*. Breeds from February to April. Generally away from human habitations. This is a very destructive bird to all small birds, robbing Doves, Bulbuls and all small birds' nests.
7	Corvus splendens ..	Common Crow ..	Common about towns and villages only. Breeds in late May, June.

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No.	Scientific name.	English name.	Remarks.
12	Urocissa occipitalis.	Red-billed BlueMag-pie.	Nest and eggs taken in forest North of District under Nepal hills. Nest placed in 'Bandha' in Rohini tree. May.
16	Dendrocitta rufa ..	Indian Tree-pie ..	Very common. Nests from April to June generally small trees. Destroys numbers of small birds' eggs.
31	Parus atriceps ..	Indian Grey Tit ..	One nest taken from old Nuthatch nest hole, 4 young and addled eggs. March. A pair were building under eves of an Inspection bungalow but were disturbed so deserted it.
105	Argya caudata ..	Common Babbler ..	Common in scrub jungle. Nests in thorn bushes. Has two broods, as eggs have been taken in March and also July. Jerdon's name for this bird should be retained, *i.e.*, Jungle Babbler, as it is only seen in jungle.
110	Crateropus canorus	Jungle Babbler ..	This is the common Babbler; occurs everywhere in the district about gardens, habitations, etc. Builds in trees at all seasons, chiefly during the Monsoon.
226	Zosterops palpebrosa.	White-eye ..	Nest well concealed among large leaves of Mowah, Mango and other trees. April to June.
243	Ægithina tiphia ..	Common Iora ..	A beautiful little cup shaped nest in bushes and small trees. June, July.
282	Molpastes bengalensis.	Bengal Red-vented Bulbul.	Very common. Nests in trees, low bushes, etc. May to July.
288	Otocompsa emeria..	Red-whiskered Bulbul.	Nests in curious positions sometimes. A lot of grass had been cut and stacked, on the top of one of these stacks a pair had built their nest. A very favourite site is creepers against walls. May to July.

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No.	Scientific name.	English name.	Remarks.
290	Otocompsa flaviventris.	Black-crested Yellow Bulbul.	Breeds in the forests. Generally in dense creepers, but one nest found was at the top of a fair sized Mango tree well concealed. May, June.
321	Sitta castaneiventris	Chestnut-bellied Nuthatch.	Holes of trees. Entrance partially closed with cowdung, mixed with gum of fig or mango tree. February, March.
326	Dicrurus annectens.	Crow-billed Drongo.	A forest bird. They breed in the forests north of the district making the usual drongo nest in forks of Dhow (*Anogeissus latifolia*) trees. Nest quite conspicuous, 3 eggs usually. Saw a monkey (*M. rhesus*) rob one of their nests, eating the eggs though savagely attacked by bird. Breeds in June.
327	Dicrurus ater ..	Black Drongo ..	Common. Breeds in June. Has two types of eggs, a white and a spotted.
330	Dicrurus cærulescens.	White-bellied Drongo	Also a forest bird, except in the winter when it may be seen in nearly every 'bagh' in the district. It makes the usual Drongo nest in forest trees, placing it in the forks of slender boughs, eggs 3—4. June.
335	Chibia hottentotta ..	Hair-crested Drongo	A purely forest bird. Breeds in the northern forests in June. Nest of the Drongo type in forks of Dhow trees Eggs 3—4.
363	Acrocephalus stentoreus.	Great Reed Warbler	Breeds among the reeds in some of the large jheels, nests attached to reeds growing in water, and about 18 inches above surface. I believe they have two broods a year as their nests have been taken in May, June and again in July, August. There are two, if not three types of egg.

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No.	Scientific name.	English name.	Remarks.
374	Orthotomus sutorius	Tailor Bird ..	Nests built into leaves sewn together, always soft-leaved and low-growing shrubs. June, July.
381	Citicola cursitans ..	Rufous Fan-tail Warbler.	A beautiful little nest, placed low down, almost on ground in thick grass. July to September.
382	Franklinia gracilis.	Franklin's Wren-Warbler.	Breeds in the Tikri jungles in August, nests in low bushes and grass.
392	Chætornis locustelloides.	Bristled Grass-Warbler.	Nest a rather large, globular structure, entrance near the top, made of coarse grass, lined fine grass, down, etc., placed in thick grass near ground. A very shy bird, if she thinks she is observed she deserts at once. Male flies round in circles uttering a tri-syllabic note. Breeds from June to August. Is very locally distributed.
464	Prinia socialis ..	Ashy Wren-Warbler.	Common. Breeds in July, August. Constructs its nest by sewing leaves of some soft-leaved plant together and lining it with fine grasses, down, etc., occasionally they make their nest in *Munj* grass, when the grass is sewn together like the nest of *P. inornata* only, *socialis*, lines her nest and *inornata* does not.
465	Prinia sylvatica ..	Jungle Wren-Warbler.	Only found in the jungles, where they build their nest in small thorny bushes. July.
466	Prinia inornata ..	Wren-Warbler ..	Very common. Nest generally in grass or sugarcane, but also attached to leaves of small shrubs. There are three varieties of eggs found in this district. A blue, a white and a green, all having the usual markings. July to September.

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No.	Scientific name.	English name.	Remarks.
469	Lanius lathora ..	Grey Shrike ..	Builds in date palms and thorny trees, common in open plains, Babul jungle. February to April.
476	Lanius erythronotus	Rufous-backed Shrike.	Fairly common, breeds in July. Nests in thorny bushes, bamboos, also trees.
500	Pericrocotus peregrinus.	Small Minivet ..	June, July. Beautiful little cup shaped nest at ends of boughs of small trees, or even bushes.
510	Graucalus macii ..	Large Cuckoo-shrike	Nest, a pad placed high up in tall trees. June. Eggs 2.
518	Oriolus kundoo ..	Oriole	Common, June, July.
521	Oriolus melanocephalus.	Black-headed Oriole.	Breeds in the forests generally but a few in the plains. They migrate in large numbers to the forests to breed in May.
544	Temenuchus pagodarum.	Black-headed Myna	Very common. Nearly every tree has a pair nesting in one of its holes. April, June.
549	Acridotheres tristis.	Common Myna ..	Very common, any hole it can find unoccupied.
551	Acridotheres ginginianus.	Bank Myna ..	Holes in wells, also banks of streams. May, June.
555	Sturnopastor contra	Pied Myna ..	Fairly common, but rather local. May, onwards.
576	Cyornis tickelli ..	Tickell's Blue Fly-catcher.	Forests. Nest in holes of trees. June.
598	Terpsiphone paradisi	Paradise Fly-catcher.	In forests and plains, but more common in forests. May, June.
604	Rhipidura albifrontata.	White-browed Fantail Flycatcher.	Fairly common. Constructs a beautiful little nest on top of a thin bough, generally a small tree. One pair built on top of tie-rod of verandah. June, July.
608	Pratincola caprata .	Pied Bush Chat ..	March, April. Nests in holes of railway borrow pits, wells, etc.

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No.	Scientific name.	English name.	Remarks.
629	Cercomela fusca ..	Brown Rock Chat ..	Has curious positions for its nest. A pair built on a ledge over the door leading into the Judge's Court in Gonda; two or three pairs on the shelves in a newly built house before the windows were glazed. They invariably build up a sort of parapet of small stones behind which the nest is constructed. June, July.
661	Thamnobia cambaiensis.	Brown-backed Robin.	April to July. Nests in all sorts curious places, holes of walls, of trees, in banks, under bricks, one nest was made in a rat hole.
663	Copsychus saularis.	Magpie Robin ..	March to July. Holes of trees, buildings, etc.
664	Cittocincla macrura.	Shama	The forests North of District. Holes in trees, old Barbet's hole.
686	Geocichla citrina ..	Orange-headed Ground Thrush.	One nest of this bird found, placed on top of a stump that had been broken off, and from which young shoots had grown. A typical Thrush nest. May.
720	Ploceus baya ..	Weaver bird ..	Very common. July to September.
722	Ploceus bengalensis	Black-throated Weaver-bird	Common. Attaches nest to *Munj* grass.
723	Ploceus manyar ..	Striated Weaver-bird.	Common. Same positions as above. Very difficult to distinguish these two birds apart.
734	Uroloncha malabarica.	White-throated Munia.	Very common. Thorny bushes and Babul trees. One nest contained ten eggs.
738	Sporæginthus amandava.	Red Munia ..	Nest placed in thick grass, very well concealed. October, November.

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No.	Scientific name.	English name.	Remarks.
775	Gymnorhis flavicollis	Yellow-throated Sparrow.	Holes in trees, one of the most difficult birds to obtain the eggs of you either find none or chicks. April to June.
776	Passer domesticus	Sparrow	Very common.
809	Cotile sinensis ..	Sand Martin ..	Very common. Holes of river banks, wells, even banks of ditches. January. February.
818	Hirundo smithii ..	Wire tailed Swallow	Generally under bridges. One nest taken from a well. February to April.
819	Hirundo fluvicola ..	Cliff Swallow ..	January, under large railway bridges.
823	Hirundo erythropygia.	Sykes' Striated Swallow.	Under culverts. and attached to roofs of old buildings. September.
831	Motacilla maderaspatensis.	Large Pied Wagtail.	Nest with chicks among roots of tree in streams. May.
847	Anthus rufulus ..	Indian Pipit ..	Very common. Grass of fie ridges in fact anywhere whe patches of grass are found.
868	Alauda gulgula ..	Sky Lark	Not common. Nest taken in short grass on edge of jheel. April
866	Alaudula raytal ..	Ganges Sandlark ..	Only one place have I found this bird breeding, this was among sand dunes on the bank of a large lake. Nests placed in tufts of coarse grass. April.
869	Mirafra cantillans .	Singing Bush Lark .	Very local. Open grass plains, borders of rivers and marshes. April, May.
871	Mirafra erythroptera.	Red-winged Bush Lark.	Common, breeds from March to August, probably two broods, nest domed, and on ground, in grass or thorny bush.

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No.	Scientific name.	English name.	Remarks.
874	Galerita cristata ..	Crested Lark ..	Season from April to July. Nest built on the ground in stunted thorn bushes.
879	Pyrrhulauda grisea.	Black-bellied Finch-Lark.	Has two broods, one in February to April, another from October. Nest always in open ground generally without any concealment.
882	Æthopyga seheriæ .	Yellow-backed Sun-bird.	Forests north of District. A nest under construction, but bird deserted it after laying one egg. Nest very like that of *A. asiatica*, but without porch. May.
895	Arachnechthra asiatica.	Purple Sun-bird ..	Very common. Builds from March to June.
919	Dicæum erythrorhynchus.	Tickell's Flowerpecker.	Constructs a beautiful little purse-shaped nest, amongst thick bunch of mango leaves, generally quite low down. March to May.
933	Pitta brachyura ..	Indian Pitta ..	Breeds in the forests all along the Nepal border. Constructs a large globular nest in thick thorny shrubs. May.
972	Liopicus mahrattensis.	Yellow-fronted Pied Woodpecker.	Distributed all over District. Nest hole in mango stump generally March.
976	Iyngipicus hardwickii.	Pigmy Woodpecker.	Often seen excavating its nest-hole but have not yet succeeded in finding the eggs. Commences operations in January, but does not lay till March or April.
986	Brachypternus aurantius.	Golden-backed Woodpecker.	Common. Commences to dig its nest hole about January, but does not lay till March, April.
1008	Thereiceryx zeylonicus.	Green Barbet ..	Commences its nest hole in November, but does not lay till April, May.

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No	Scientific name.	English name.	Remarks.
1019	Xantholæma hæmatocephala.	Crimson-breasted Barbet.	Very common. April to June.
1022	Coracias indica ..	Indian Roller ..	Holes of trees. April, May.
1026	Merops viridis ..	Indian Bee-eater ..	Burrows in banks, bunds, etc. May, June.
1027	Merops philippinus.	Blue-tailed Bee-eater.	Partially migratory, comes here about March, April when it commences to look out for nesting site. They make their holes in river banks, field bunds, etc.
1031	Nyctiornis athertoni.	Blue-bearded Bee-eater.	Breeds in holes of stream banks in the forests. Nest holes are sunk deep, 8 to 10 feet.
1033	Ceryle varia ..	Pied Kingfisher. ..	Common along all the streams, in the banks of which they nest. January, April.
1043	Pelargopsis gurial ..	Stork-billed Kingfisher.	Several of their nest holes examined but no eggs found, they select the heavily-wooded streams in forests.
1044	Halcyon smyrnensis.	White-breasted Kingfisher.	Fairly common. Nests in banks, either streams, or tanks.
1053	Anthracoceros albirostris.	Indo-Burmese Pied Hornbill.	Common in the northern forests here. Large holes in trees, the entrance to which is partially closed after the female has entered. Whilst she is sitting all her feathers fall off I am told ; how she manages, on being liberated 'informant sayeth not.' Lay in April, May.
1062	Lophoceros birostris.	Grey Hornbill ..	Very common all over this District. Lays in holes of large trees, partly closing entrance after female has entered, the hen does not lay her eggs immediately she shuts herself up, as I have on three occasions dug out the hole to find no eggs, although the male bird was seen feeding her. Lays in May.

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No.	Scientific name.	English name.	Remarks.
1067	Upupa indica ..	Indian Hoopoe ..	Common. Nests in holes of building trees. February, March.
1073	Cypselus affinis ..	Indian Swift ..	Local. Builds in buildings, the jail a favorite place.
1086	Macropteryx coronata.	Crested Swift ..	Two nests taken in the northern forests; the nest, a small bracket, is attached to a horizontal branch high up on a tall tree, the egg, a single one, is laid in this. The hen bird sits upright on it, as if she were perched on the bough,not lying as an ordinary bird does; ordinarily you would not suspect that the bird was sitting on a nest at all. June.
1093	Caprimulgus macrurus.	Horsfield's Nightjar.	.Common in the forests, lays on dead leaves, no attempt at nest. May, June.
1109	Hierococcyx varius.	Crested Hawk-Cuckoo.	Egg taken in nest of *Argya caudata* with two of the latter birds. July.
1118	Coccystes jacobinus.	Pied Crested Cuckoo	Common in the rains. Lays in in nest of *C. canorus*.
1120	Eudynamis honorata.	Koel	Lays in crows' nests. taken 4 eggs from one nest. July.
1128	Rhopodytes tristis .	Large Green-billed Malkoha.	Northern forests. Large globular nest in thick creepers. June.
1129	Taccocua leschenaulti.	Sirkeer Cuckoo ..	Thick and thorny creepers climbing up trees. April to July.
1130	Centropus sinensis..	Coucal or Crow Pheasant.	Large domed structure in heavy creepers generally, but I once found one in a Babul tree without a leaf. July to September.

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No.	Scientific name.	English name.	Remarks.
1135	Palæornis nipalensis.	Large Paroquet ..	Nests in holes of large forest trees. April, May.
1138	Palæornis torquatus.	Rose-ringed Paroquet	Very common. Holes of trees. May, June.
1139	Palæornis cyanocephalus.	Western Blossom-headed Paroquet.	Common as above.
1141	Palæornis schisticeps.	Slaty-headed Paroquet.	In forests under hills. Eggs not taken, but nest holes examined.
1152	Strix flammea ..	Screech Owl ..	Very local. Lays about February, in holes of trees.
1161	Syrnium ocellatum .	Mottled Wood-Owl.	Common over district in suitable localities. Lays two eggs in hollow formed where branches separate. February, March.
1164	Ketupa zeylonensis.	Brown Fish-Owl ..	Generally spread over District. Eggs 1, 2, in the hollow formed where large limbs separate. Has a deep tri-syllabic call-hoot.
1169	Bubo coromandus. .	Dusky Horned-Owl.	Generally occupies an old nest of a vulture, kite or eagle, usually in a grove of trees, but occasionally on a solitary one, I found one pair had taken up an old *A. vindhiana* nest in a solitary Pipal tree. November to January.
1178	Scops bakkamœna..	Collared Scops Owl.	One nest taken, from hole in mango tree. March.
1180	Athene brama ..	Spotted Owlet ..	Very common. March, April. Holes of mango trees.
1184	Glaucidium radiatum.	Jungle Owlet ..	Lays in holes of trees in March.
1187	Ninox scutulata ..	Brown Hawk-Owl.	A shikari brought the eggs (4) and part of the skin of this bird. He found the nest in the hole of a mhowa (*Bassia latifolia*) in the forest. March.

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No.	Scientific name.	English name.	Remarks.
1191	Otogyps calvus ..	Black or King Vulture.	Nest built on top of solitary trees, generally Pipal, January, Febuary. A plucky bird, I sent a man up to a nest on a large Pipal on which the bird was sitting; on the man's approach she went for him, driving him off, he then got a stick, even then she refused to allow him to go near nest, she had a newly hatched chick so I called man down.
1194	Gyps indicus ..	Long-billed Vulture.	Only one nest found, this was on top of solitary Pipal tree; there was no doubt of the bird as I watched her with binoculars whilst the man was climbing tree. There are numbers of this and *G. tenuirostris* in this District, and as there are no cliffs for them to build on, they have perforce to build on trees. December.
1195	Gyps tenuirostris ..	Himalayan Long-billed Vulture.	I have found three nests of this bird, two contained eggs, the 3rd a chick, two were on top of solitary trees, the 3rd (7th January, 21), a hard-set egg, was an old *P. bengalensis* nest, occupied by that bird only last year. December, January.
1196	Pseudogyps bengalensis.	White-backed Vulture.	Very common. November to January.
1197	Neophron gingini-unus.	Small Scavenger Vulture.	Birds are common, but I have only found 4 nests. One pair have each year used the same site, *i.e.*, about 30 ft. up a Pipal tree, where a large limb separates; this pair have very handsomely marked eggs. March, April.

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No.	Scientific name.	English name.	Remarks.
1203	Aquila vindhiana ..	Tawny Eagle ..	A common bird in this District. Breeds from November to January ; places its nest on the very top of isolated trees nearly always a Pipal. Out of 16 nests examined, 7 had one egg each, 8 two, and 1 three.
1217	Spilornis cheela ..	Crested Serpent Eagle.	Breeds along the Kohany river, a thickly wooded and deep stream. Nest in large trees. April, May.
1220	Butaster teesa ..	White-eyed Buzzard	Very common. Nests in thick trees. April, May.
1223	Haliaëtus leucoryphus.	Pallas's Fishing Eagle.	Builds a huge structure, generally on top of some large tree near a lake or jheel. November, December.
1226	Polioaëtus ichthyaëtus.	Grey-headed Fishing Eagle.	Locally distributed; found along well wooded streams or marshes in forests. Builds a large nest, well concealed, about the centre of some forest tree. They use the same nest year after year, even after it has been robbed; what is more, I took an egg from a nest on 9th November, on 6th March I again visited nest and she had laid again in same nest. Again on 15th March next year, the same pair occupied the same nest, I took one fresh egg. On 31st March she was on the nest, on sending up a man there was an egg, slightly set.
1228	Haliastur indus ..	Brahminy Kite ..	Lays in April and May, eggs 1 to 3.
1229	Milvus govinda ..	Common Kite ..	Commences carrying sticks in November, but does not lay till March or even later.

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No.	Scientific name.	English name.	Remarks.
1232	Elanus cæruleus ..	Black-winged Kite .	This bird's nest only found this year, it had only two eggs, this was on the 14th December. I have often seen the bird about, but never found nest before.
1244	Astur badius ..	Shikra ..	Generally distributed over the District. Builds in *Bandha* (mistletoe) that is so common on mango trees. April to June.
1249	Pernis cristatus ..	Honey Buzzard ..	Very local. Breeds in May, but very local, chiefly in the northern forests.
1271	Crocopus phœnicopterus.	Bengal Green Pigeon	Builds its usual flimsy nests in small trees ; is very shy of observation ; will desert nest even with egg in it if she sees she is observed. March, May.
1291	Chalcophaps indica	Bronze-winged Dove	Breeds in the forests in May.
1292	Columba intermedia	Blue Rock-Pigeon .	Nests in wells, under railway bridges, under aves of houses, even in holes of trees.
1307	Turtur suratensis ..	Spotted Dove ..	Very common. Nests everywhere and all year round.
1309	Turtur cambayensis	Brown Dove ..	Not so common as last, but generally found all over District. Breeds all year round.
1310	Turtur risorius ..	Ring-Dove ..	The most common dove, lays all year, and in all sorts of places.
1311	Œnopopelia tranquebarica.	Red Turtle-Dove ..	Generally makes its nest in small mango trees in May and June, but I believe it has another brood later.
1324	Pavo cristatus ..	Peafowl	Generally distributed all over District but very plentiful in the forests. Breeds in suitable localities. April to June.

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No.	Scientific name.	English name.	Remarks.
1328	Gallus ferrugineus.	Red Jungle-fowl ..	Only found in the forests, where it breeds in May, June. It is wonderful how the young chicks hide, I saw a hen with about 6 or 7 chicks, there was no cover except dry leaves ; we went quickly up, the hen flew off, and the chicks had vanished ; we searched very carefully, so as not to crush any but not a chick could we discover, and yet they were there.
1355	Coturnix communis	Grey Quail ..	Chicks seen in grass and thorn scrub in August, so she must have had her nest near by. The eggs have been brought to L. P. Hutchison by shikari.
1372	Francolinus vulgaris.	Black Partridge ..	Fairly plentiful in the southern parts of District, where it breeds. A large number of their eggs are however destroyed by mungooses, rats, snakes and also crows. I have found numbers of nests with egg shells scattered about. Their chicks too have a bad time.
1375	Francolinus pondicerianus.	Grey Partridge ..	Only found along the jungles. Breeds in May, June.
1382	Turnix pugnax ..	Bustard Quail ..	Plentiful in the grass jungles, where it breeds in June, July.
1393	Porzana pusilla ..	Eastern Baillon's Crake.	One nest of this bird was taken in 1911. Consisted of a few weeds, piled on a water lily leaf, well concealed in wild rice. 2 eggs. August.
1401	Amaurornis phœnicurus.	White-breasted Water-hen.	Very common and a very familiar bird. Frequents village pools, breeds everywhere, generally, nest placed in thick bushes or bamboo clumps. July, August.

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No.	Scientific name.	English name.	Remarks.
1403	Gallicrex cinerea ..	Kora or Water Cock.	Nest a pad of wild rice stems pressed down, well concealed in dense wild rice. Eggs 5, 6. August.
1409	Porphyrio poliocephalus.	Purple Moorhen ..	Breeds in the larger jheels, making its nest, which consists of bent down grasses to form a pad, well hidden in growing plants. July, August.
1409	Grus antigone ..	Sarus	A few pairs here and there about the District, where large jheels exist. Nest a huge pile of water weeds, collected together, over which they both labour for weeks. August.
1418	Œdicnemus scolopax.	Stone-Plover ..	Common, no nest, merely hollow in ground, sometimes in a ploughed field, at others amongst scrub bushes. March, April.
1419	Esacus recurvirostris.	Great Stone-Plover.	On sand banks of the larger rivers. June.
1428	Metopodius indicus .	Bronze-winged Jacana.	Plentiful on all the larger jheels, making their nests, a pad of lily leaves, on top of a large leaf, or on lump of grass. Eggs 4. July, August.
1429	Hydrophasianus chirurgus.	Pheasant-tailed Jacana.	Very common on all pieces of water covered with lily leaves, on which they make their nest. July, August.
1431	Sarcogrammus indicus.	Red-wattled Lapwing.	Common everywhere. Eggs taken from April to August.
1433	Sarciophorus malabaricus.	Yellow-wattled Lapwing.	Local, where there are large open plains. Nest, a depression with small clods of earth placed round it. April, May.
1435	Hoplopterus ventralis.	Spur-winged Plover	On sand banks of large rivers. April, May.

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No.	Scientific name.	English name.	Remarks.
1447	Ægialitis dubia ..	Little Ringed-Plover	A few pairs breed here, where there are sand dunes near some large lakes. I have only found two nests, one 2 eggs, the other 3. February, March.
1496	Hydrochelidon hybrida.	Whiskered Tern ..	Very local, only breeds in certain jheels in August.
1503	Sterna seena ..	River Tern ..	On the sand islands of the two large rivers flowing through District.
1504	Sterna melanogaster	.Black-bellied Tern .	As above.
1528	Phalocrocorax javanicus.	Little Cormorant ..	Nests in colonies on stunted trees growing in water, along the banks of the Gogra river, where it overflows forming backwaters. In these places a great many kinds of aquatic birds congregate to breed. July.
1529	Plotus melanogaster.	Snake-Bird ..	Along with the previous noted bird.
1542	Inocotis papillosus .	Black Ibis	The only places I have found these birds breeding are on huge Semal (*Bombax malabaricum*) trees on the outskirts of the forests, in May and June. They select a tree on which bees have made their hives, so the only way I could get their eggs was to get the Bhars, who make a living by taking the honey to go up at night.
1548	Dissura episcopus ..	White-necked Stork.	This bird also selects these trees, and generally the same tree as the Ibis, only they occupy one of the lower boughs, whereas the Ibis builds right on top. Here they breed in May, but in other parts they build in July, or later, perhaps they have two broods ?

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No.	Scientific name.	English name.	Remarks.
1549	Xenorhynchus asiaticus.	Black-necked Stork.	Makes a huge nest of sticks on top of a high and solitary tree in November, December. On one occasion I found two nearly full grown chicks and two fresh eggs, as already noted in the Journal.
1553	Anastomus oscitans.	Open-bill	Breeds in large colonies, generally on trees growing out of jheels, or on large trees in villages. July, August.
1554	Ardea manillensis ..	Purple Heron ..	Nests placed in, and on dense reeds or on stunted trees in jheels, gregarious. July, August.
1555	Ardea cinerea ..	Blue Heron ..	Builds on large trees, in colonies in July.
1561	Herodias garzetta ..	Little Egret ..	Only found one colony, they were breeding together with *A. grayi* on a Pipal tree in a village on the bank of the Gogra river. July.
1562	Bubulcus coromandus.	Cattle Egret ..	Large numbers breed together on trees in villages. July.
1565	Ardeola grayi	Pond Heron ..	On trees in villages. July.
1568	Nycticorax griseus .	Night Heron ..	Large numbers nest together with the little cormorant and snake bird, they also build on trees in villages. I found one colony breeding in the latter place in April, but in the former in July.
1571	Ardetta sinensis ..	Yellow Bittern ..	In thick reeds in marshes. July, August.
1572	Ardetta cinnamomea	Chestnut Bittern ..	One nest in a screw-pine on edge of lake, but usually among thick reeds. August.
1584	Sarcidiornis melanonotus.	Comb Duck or Nukta.	Holes of large trees. July to September.

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No.	Scientific name.	English name.	Remarks.
1589	Dendrocycna javanica.	Whistling Teal ..	Among wild rice.
1591	Netopus coromandelianus.	Cotton Teal ..	Holes of large trees. August September.
1617	Podiceps albipennis	Little Grebe ..	A pad of water plants, among weeds, July to September.

List of birds whose eggs have not been taken, but which are believed to breed in this District.

339	Bringha remifer ..	Lesser Racket-tail Drongo.	Occurs in the forests and is a permanent resident.
473	Lanius vitattus ..	Bay-backed Shrike.	Seen in the forests in May, so probably breeds.
495	Pericrocotus brevirostris.	Short-billed Minivet.	Saw a single male in forest, appeared to be feeding female on nest.
1066	Upupa epops ..	European Hoopoe..	Birds seen during breeding season, but nest not found.
1107	Cuculus micropterus	Indian Cuckoo ..	Appears each year in July, calls continuously day and night for over a month.
1112	Cacomantis passerinus.	Plaintive Cuckoo ..	Heard and seen it in June in forests.
1153	Strix candida ..	Grass Owl	Birds seen in grass patches, in October, November. Two eggs brought in by birdcatcher, said to be this bird's, to L. P. Hutchison from just over Nepal frontier. Found in heavy grass.
1168	Bubo bengalensis ..	Rock Horned-Owl..	Birds fairly plentiful along cliffs of forest streams. Eggs not taken.
1173	Scops giu	Scops Owl	Hen bird captured in forest that had evidently been sitting on eggs.

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No.	Scientific name.	English name.	Remarks.
1205 to 1206	Aquila maculata or Aquila hastata.	Large or Small Spotted Eagle.	I am not sure which of these birds has built her nest in a large mango 'bagh' for the last two years, I did not shoot it as I wanted the eggs, but I was always too late for eggs, but I saw birds feeding young.
1283	Sphenocercus sphenurus.	Kokla Green Pigeon.	Heard calling in forest in May, June.
1354	Excalfactoria chinensis.	Blue-breasted Quail.	Twice seen pair in heavy grass and apparently feeding young.
1356	Coturnix coromandelica.	Rain Quail ..	Said to breed here.
1416	Sypheotis aurita ..	Likh or Lesser Florican.	Seen in breeding plumage in the large grass patches in the forests, Shikaris say they have eggs in the grass.
107	Argya malcolmi ..	Large Grey Babbler.	This bird is very local, found in small parties in parts of the District where there are patches of Babul jungle, and is a permanent resident, but I have not found the eggs.

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LIST OF MOLLUSCA OF RANGOON.

BY

DR. H. MARSHALL.

(A.) FRESH WATER MOLLUSCA.

1a. *Melanoides tuberculata*, Müller.—(F. B. I. No. 28. *Tiara* (*Striatella*) *tuberculata*). This is a common species in Rangoon. The majority of specimens obtainable are very small, and light coloured. Some medium sized specimens were obtained from the Cantonment Garden tanks and Municipal tank in Creek Street. These are very dark in colour.

2a. *Melanoides scabra*, Müller.—(F. B. I. No. 60. *Tiara* (*Plotia*) *scabra*). Specimens of this mollusc were only obtained from the Royal Lakes. They are dark in colour and much decollated.

3a. *Acrostoma variabile* (Benson).—(F. B. I. No. 39. *Tiara* (*Melanoides*) *variabilis*). This is not a very common species in Rangoon. The local variety bears as a rule strong longitudinal ribs and is very dark in colour, some specimens being covered with a thick black deposit. Very occasionally somewhat lighter and more delicate specimens are obtainable and these are marked with two brownish bands on the last whorl. Specimens which are almost smooth and of a light olive colour ornamented with brown bands on the last whorl are sometimes brought into the market with prawns. I have not been able to ascertain as to where these specimens come from.

4a. *Vivipara bengalensis var : digona* (Blanford).—(F. B. I. No. 179. *Vivipara digona*). This is a common species found in almost all tanks, ponds, and ditches. Very beautiful specimens are obtainable in the Kokine Lakes.

5a. *Vivipara bengalensis var : doliaris* (Gould).—(F. B. I. No. 168. *Vivipara doliaris*). Specimens which I take to be this variety do not appear to be anything like as common as *digona*. Most of the specimens obtainable are small. [1]

6a. *Vivipara heliciformis var : viridis*, Reeve.—(F. B. I. No. 185. *Vivipara* (*Idiopoma*) *heliciformis* var : *viridis*. Specimens which I take to be this variety were only found on one occasion.

7a. *Vivipara dissimilis* (Müller).—(F. B. I. No. 174. *Vivipara dissimilis*). Specimens of a uniform green colour with spire not much produced were obtained. I take these to be some variety of *dissimilis*.

8a. *Pachylabra conica* (Gray).—(F. B. I. No. 197. *Pila conica*). This is a very common species in Rangoon. Two varieties are obtainable, one unicoloured which is usually of a large size, the other variously banded with brownish bands. The banded specimens do not appear to reach the size of unicoloured specimens. This species is eaten by many classes of Natives, and many persons are employed in the trade who gather the Molluscs and take them round to private houses for sale. This mollusc along with *Vivipara bengalensis*, *Indoplanorbis exustus*, and *Melanoides tuberculata* are largely collected by the Chinese duck farm owners for the feeding of ducks.

9a. *Limnæa acuminata*, (Lam.)—(F. B. I. No. 211. *Limnæa* (*Limnæa*) *acuminata*). All specimens obtainable in Rangoon appear to be dwarfed. Two varieties have been found ; one something like variety *amygdalum*, Troschel, and the other variety *nana*, Annandale (Rec. Ind. Mus., Vol. XVI, Part 1, No. 6). This species is only obtainable from about October till the end of the year, after which it disappears.

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[1] *V. bengalensis* var : *digona* has now been merged in *doliaris* (Rec. Ind. Mus. Vol. XXII. Part 2II, No. 20, p. 272.)

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10a. *Limnæa pinguis* (Dohrn.)—(F. B. I. No. 222. *Limnæa* (*Gulnaria*) *pinguis*). Only a few specimens were obtained but have apparently been mislaid.

11a. *Indoplanorbis exustus*, Desh.—(F. B. I. No. 227. *Planorbis exustus*). This is the commonest fresh water mollusc obtainable in Rangoon. This species is known to carry *Schistosoma spindalis* also a *cercaria* morphologically identical with that of *Schistosoma japonicum*.

12a. *Gyraulus convexiusculus* (Hutton).—(F. B. I. No. 234. *Planorbis* (*Gyraulus*) *convexiusculus*). A couple of specimens were found in the Pazundaung quarter of the town. This species is fairly common in Kamayut just outside Rangoon. Probably *Gyraulus euphraticus*, Mousson, will also be found here.

13a. *Lamellidens marginalis* (Lam.)—(F. B. I. No. 310. *Lamellidens marginalis*). This is a fairly common species in Rangoon. The following varieties have been obtained: (1) *generosus* (Gould). Usually large specimens; (2) *corrianus* (Lea). Not common; (3) *scutum* (Sowerby). Fairly common. There are specimens of var: *zonata* (Desh.) in the Indian Museum collection from Rangoon, but in spite of much searching I have not been able to find any.

14a. *Cyrena bengalensis*, (Lam.)—(F. B. I. No. 328. *Cyrena bengalensis*). After much searching a few living specimens were found at Dawbong and in a drain in Upper Pazundaung Road.

(B.) Land Mollusca.

1b. *Streptaxis burmanicus*, Blf.—(F. B. I. No. 6. *Streptaxis burmanicus*). A single dead specimen (small variety) was picked up in Kemmendine.

2b. ? *Macrochlamys sp.*—This species at first sight looks very much like *Indoplanorbis exustus*. Specimens of this were sent to J. Cosmo Melville and he was of opinion that this was probably a juvenile *Plectophylis*. The specimen sent was apparently imperfect. I am certain that even young specimens are not tomentose.

3b. *Macrochlamys molecula*, Benson.—(F. B. I. No. 195. *Macrochlamys ? molecula*). After much searching specimens have not been found.

4b. *Austenia peguensis*, Theobald.—(F. B. I. No. 297. *Austenia peguensis*). This is a common species at Hlawga which is about twenty miles from Rangoon. Only a single specimen has been taken locally.

5b. This small species was obtained in the Kemmendine Cemetery. I have not been able to identify it.

6b. *Pupisoma lignicola*, Stol.—(F. B. I. No. 49. *Pupisoma lignicola*). This species has been recorded from Rangoon by Hungerford, but I have not been able to obtain it.

7b. *Eulota similaris*, Fer.—(F. B. I. No. 173. *Eulota similaris*). This species is plentiful in Rangoon. All the specimens obtained were unicoloured.

8b. *Eulota sp.*—This is a small, extremely fragile, transparent, highly polished shell. The animal is not able to withdraw itself within the shell. It looks very like a *Eulota*, but I have not been able to identify it.

9b. *Opeas gracile*, Hutton.—(F. B. I. No. 317. *Opeas gracile*). This is a fairly common shell in Rangoon, but no specimens of *Ennea bicolor* Hutton, were found associated with it.

10b. *Succinea semiserica*, Gould.—(F. B. I. No. 448. *Succinea semiserica*). This is a very common species in Rangoon.

11b. *Vaginulus birmanicus*, Theobald.—(F. B. I. No. 478. *Vaginulus birmanicus*). This slug is fairly common in Rangoon.

12b. *Cyclophorus auranticus*, Schumacher.—This species is very localised, but where found is usually plentiful. Rangoon specimens appear to be somewhat like var: *andersoni* (Fauna of Mergui, von. Martens, p. 159)

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but more white round the umbilicus. Very young specimens are almost transparent, and mottled with reddish brown. Young specimens before the lip is formed are very deep reddish brown. Full grown adult specimens greyish brown. Very old specimens seem to lose their colour and become almost white, though the peristome never loses its colour.

(C.) River Mollusca.

1c. *Cerithium lemniscatum*, Qusay and Gaimard.—This species is recorded from Rangoon by von Martens.

2c. *?? Cerithidea sp.*—A large specimen something like a *Cerithium* was taken at Dawbong, Rangoon. I have also a specimen from Kyanktan, Burma. Having no books dealing with *Cerithium* and its allies I am not able to say what this is.

3c. *Turritella columnaris*, Kiener.—This species has been recorded from Rangoon by von Martens. I have not been able to obtain specimens.

4c. *Littorina rubropicta*, von Martens.—(Fauna of Mergui, p. 170). This is a very common species in Rangoon. Specimens obtained in Kyanktan, Burma, are much larger than Rangoon specimens.

5c. *Littorina subintermedia*, Nevill.—This specimen was kindly identified for me by Dr. Annandale of the Indian Museum. It is fairly common attached to stones on the banks of the river.

6c. *Assiminia francesciæ ?*, Gray.—These specimens were very kindly identified for me by Dr. Annandale as probably *francesciæ*.

7c. *Assiminia sp.*—These specimens are red in colour and might possibly be *A. brevicula*, Pfeiffer, but unfortunately no books are available giving the description of this species.

8c. *? Rissoina sp.*—These specimens were found on the river training walls. I am unable to say what they really are.

9c. *Larina burmanorum*, Blanford :—This species has been recorded from the Rangoon River (Burma, Its People, and Productions, Vol. I, p. 157). I have not been able to obtain any specimens.

10c. *Neritina crepidularia*, Lam. :—(Fauna of Mergui, p. 171). Black (lower surface) coloured specimens (*Dostia cornucopiæ*) are usually found mixed with typical red (lower surface) specimens. The periostracum varies from olive green to almost black. Some specimens being very prettily marked with black lines resembling somewhat Arabic writing.

11c. *Neritina sp.*—These are small and very dark being whitish below. I at first took them for young of *N. crepidularia* but probably they are a separate species.

12c. *Nerita sp.*—Only one specimen was taken and I am unable to identify it.

13c. *? Siphonaria sp.*—This limpet is very plentiful. I cannot say whether it is really a Siphonaria or not.

14c. *Auricula judæ*, L.—Specimens apparently representing this species have been taken near Monkey Point in decaying vegetable matter. They are not common.

15c. *Auricula sp.*—This is the common *Auricula* of Rangoon, and may, perhaps, be *A. gangetica*.

16c. *Pythia plicata*, For.—This species is mentioned by von Martens as from Rangoon. Many specimens have been taken on trees from two localities. (1) trees on bank of tidal drain Lower Pazundaung Road, (2) trees in marshy land exposed to tide near Monkey Point. *Auricula* and *Pythia* have been so far found in the same localities, but *Auricula* has never been seen on trees. *Pythia* appears to be more of a land shell than a salt water species.

17c. *Pythia trigona*, Troschel.—This species is also recorded from Rangoon

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by von Martens. It is much rarer than *P. plicata*, only having been taken from one locality in small quantities.

18c. *Turbo margaritaceus*, L.—This species has been recorded from Rangoon by von Martens, but after much searching I have not been able to find a specimen.

19c. ? A single specimen of a Mollusc somewhat broken was found. This is probably a *Littorina* of some kind.

20c. *Mytilus curvatus* Dunker ? :—Some young specimens which might possibly be this were found on the training wall, but I am not able to say really what they are.

21c. ? Two or three apparently young bivalves were taken from the river training wall. These may perhaps belong to the genus *Modiolus*. [2]

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2 *Stenothyra monilifera*, Benson, should be included in the estuarine fauna of Rangoon.

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View of the Exhibition in the Mammal Gallery of the Prince of Wales Museum of Western India, on the occasion of the Royal Visit to Bombay November, 1921.

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THE PROGRESS OF THE NATURAL HISTORY SECTION IN THE PRINCE OF WALES' MUSEUM OF WESTERN INDIA.

BY

B. C. ELLISON, C. M. Z. S.

(*With 2 plates.*)

Since the scheme for the arrangement of the collections of the Bombay Natural History Section in the Prince of Wales' Museum was brought out (a synopsis of which appeared in Volume XXVII. No. 4 of the Journal) matters have progressed more or less rapidly with regard to the transference of the Society's collections.

On account of H. R. H. the Prince of Wales proposed visit to the Museum it was decided in August 1921 that the first arrangement of the collections in the New Museum should be made with a view to show him something about the Animal and Bird life of India. An exhibition was therefore arranged of some of the more representative animals and birds found in this country, the specimens being selected particularly from the point of view of sporting interest. By comparing the photos shown in the present number of the Journal and the photos which appeared in Volume XXVII, No. 4, one is able to see the transformation in the appearance of the galleries after three months work. Though not arranged in its final form, nevertheless a very creditable exhibition was made which was favourably commented upon both by the public and the press.

A general guide book to all the Sections of the Museum was compiled, the pages of which gave a brief account of the Natural History Exhibition in the Museum. This was illustrated with a map showing the areas covered by the Society's Mammal Survey and photos of various game animals. A chart was also prepared giving the measurements of the best horns in the Society's collection compared with hitherto published records. Three beautifully bound copies were presented to H. R. H. The Prince of Wales, the Viceroy and to H. E. the Governor of Bombay respectively in which were included some of the beautiful plates which have appeared in the "Game Birds of India, Burma and Ceylon" by E. C. Stuart Baker, F.Z.S., etc.

The principal exhibit in the Mammal Gallery illustrated the work of the Society's Mammal Survey. Along the central row of tables a series of skins ranging from Primates to Pangolins were grouped according to classification. These were further embellished with photographs and maps showing distribution, etc. A separate exhibit illustrated the large number of genera and species which had been added to the list of the Indian Fauna through the agency of the survey. The Society's fine collection of Big Game Horns was shown to very great advantage on the walls of the gallery.

An endeavour had been made to procure the best photos possible of Indian animals shown under natural conditions. Through the kindness of many of the Society's sporting members a good representative collection of these were obtained and were enlarged and framed and placed underneath trophies or side by side with the unmounted specimens. In addition to the enlarged photos were numerous others sent by members from all over India. These were shown especially for people interested in Big Game Shooting. There was a magnificent collection of fine photos presented by H. H. the Maharaja of Bikaneer and numerous members. H. H. the Maharaja of Dhar, Mr. J. Ridland and others lent their trophies for the exhibition. One cannot but comment on the beautiful

Bombay November, 1921.

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Tiger skins loaned to the Society by the latter gentleman. These formed an extremely striking exhibit on the walls of the gallery. The labelling of the exhibits was a matter that demanded particular attention. Experience has shown that the ordinary type of label is very apt to rapidly deteriorate under local climatic conditions, and a satistactory expedient was found in having all the large printed ones framed under glass *pari passu*.

In the Bird Gallery (which had been temporarily housed in the Gallery marked (3) in the general scheme) perhaps the most interesting exhibition besides the splendid display of skins and paintings of Indian Game Birds was the portion allotted to Egrets in the little gallery at the end of the alcove. Through the kindness of the Commissioner in Sind, specimens of these birds procured from the farms, together with samples of plumes and photographs of the birds in various stages of development, were shown.

The method of exhibiting specimens by means of plaster casts whereby a number of Mr. Prater's beautiful life-like casts of the commoner Indian snakes were shown, attracted considerable attention.

The Natural History Section was open to the public for a week during the time of the Prince's visit. Sir Perry Robinson, Special Correspondent of *The Times*, was one of many who spent an afternoon in the Natural History Section. He wrote a very appreciative article on his visit

The expenses incurred in connection with the transfer of collections, including the cost of tables hired and purchased, amounted to Rs. 10,068.

The impression gathered by the visitor in many Museums is one of mustiness and decay. This has rather the effect of detracting much from the utility of these institutions, and turns them into caverns of mouldy antiquities. Every effort, therefore, was made in the present instance to avoid the above effect. Our object being to interest as well as to instruct.

Early in January His Excellency the Governor and Lady Lloyd paid a private visit to the Natural History Section. Their Excellencies were met by the Managing Committee of the Society and conducted over the Section by Mr. R. A. Spence and Mr. Prater. The writer was unable to be present on the occasion being in Nepal at the time. Their Excellencies expressed themselves very favourably as to the arrangement of the section. His Excellency showed a great interest in its future and very kindly promised his assistance in furthering the plans put forward by the Honorary Secretary, which were chiefly concerned with the question of funds and the ways and means of their acquirements.

The great drawback affecting the running of Museums and kindred institutions in India as elsewhere seems to be a cramping lack of funds. The writer is of opinion that disadvantageous as it may seem to the aims of a public institution such as a Museum, a small charge to visitors on every day of the week, except perhaps one, would go far towards remedying this deplorable condition.

The exhibition hitherto arranged was purely of a temporary character and the specimens arranged on tables, etc., could not possibly continue in their present condition without the risk of infinite harm. Unless properly protected under airtight cases they become an easy prey to the attacks of *Dermestes* and mites. It was decided, therefore, to disband the present exhibition until suitable show cases had been provided for the housing of the collections. Arrangements were speedily concluded with Messrs. Chung Sang & Co. of Calcutta who had already erected cases for the Art and Archæological Sections and who had had considerable previous experience in the construction of cases for Museums. Designs for their arrangement were prepared and approved of. One cannot but comment on the valuable assistance rendered by Mr. Prater who during the

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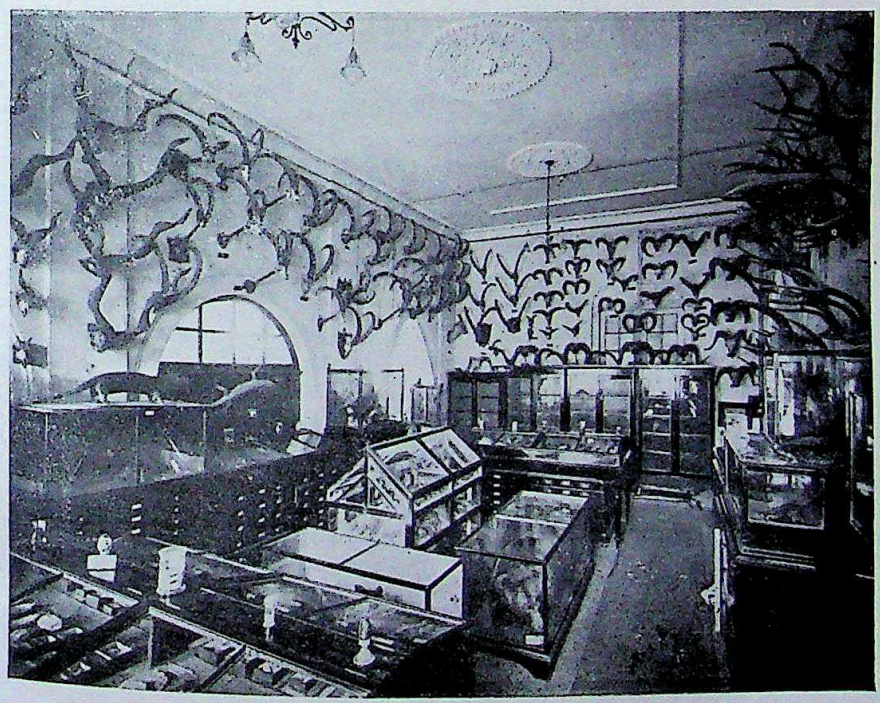
The Game Bird Section as seen at the time of the Exhibition.



"In Perpetuam Rei Memoriam."

One of the Society's old rooms at 6, Apollo Street. Its overcrowded condition will show the urgent need there was for additional space.

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writer's absence on the Prince's shoots at this critical period had the onus of this work thrown on his shoulders. A considerable saving in the cost was affected through the Honorary Secretary, who previous to accepting the local estimates for plate glass cabled for the current prices in England with the result that the estimate was reduced by the substantial sum of Rs. 16,000.

The cases for the Mammal Gallery which are now completed; have been designed on the latest principles; they are air-tight and constructed of the best seasoned teak available.

The next question before us is the filling of the cases. The problem of mounting animals was one that required considerable deliberation. The usual policy in the past was to have the animals mounted by a Taxidermist attached to the Museum. The man was usually poorly paid and had the vaguest notion of the work he was attempting to do. This often resulted in a horrible collection of monstrosites. Taxidermy is at the present day a fine art, and in England and America is attracting quite a superior type of man to the bird stuffer of old. After consultation with Experts in England and comparison of the estimates proffered by one or two well-known Taxidermist firms in India, it was discovered that it would be decidedly more advantageous if the Museum could secure for itself either the services of a trained taxidermist to mount the animals himself or some one with sufficient knowledge to supervise the carrying out of this work. It was, therefore, decided to send the Society's Assistant Curator to England in this connection. We are fully convinced that the course adopted will be of extreme advantage to the Museum.

As regards the remaining galleries funds will not allow of our touching these until we have completed the Mammal Gallery. When this is finished it is proposed to take up the Bird Gallery and then the remaining sections.

Many members will be wondering about the old rooms in Apollo Street, clinging to which are a host of memories. These are and will still continue to be the offices and headquarters of the Society and here will still be housed the reference collections. Except for the giving up of one room, and sundry gaps and vacancies on the walls caused by the transference of trophies to the Prince of Wales Museum (these gaps are being rapidly filled however) the old rooms continue the same as formerly. *In perpetuam memoriam*, we publish the photo of the room no longer tenanted by the Society.

BOMBAY NATURAL HISTORY SOCIETY, 12*th June* 1922.

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REVIEW.

THE EDGE OF THE JUNGLE. By William Beebe, (Witherby). 12*s.* 6*d.*

The 'Edge of the Jungle' is a series of essays on observations of Natural History in Guiana.

The author Mr. William Beebe has travelled widely as a scientific naturalist: he is apparently mainly a biologist setting up a laboratory wherever he goes in the jungles, but he is also a very close and careful observer of Nature, and his record of the daily routine of a nest of Army Ants watched at the risk of extreme discomfort is of the greatest interest.

Unfortunately Mr. Beebe has gained a reputation for language "holding all the charm of an essay by R. L. Stevenson" (*vide* wrapper), and he laboriously and self-consciously upholds that reputation by giving us fifteen annas of fine writing to every anna of information, which is not, by the way, the method of R. L. S. The result is that in this book we find many tantalising allusions to Mr. Beebe's experiences in Borneo, Egypt, China and the "Queen's Golden Monastery in Northern Burma within storm sound of Tibet" and almost the only thing we learn about the Natural History of Guiana is that the mongoose (described of course *a la* R.L.S. as "that furry fiend Rikki tikki") has been introduced into the country, and is 'having a rather hard time of it.'

We in India perhaps hardly realise what a literature of Natural History and Sport has been built up for us by plain men telling us what we want to know in plain language.

The model of all books on the wanderings of a Naturalist, though we cannot claim it for India, is Wallace's Eastern Archipelago. But in India we have writers like the "Old Forest Ranger," Simson, Hume, Marshall, Eha, Stuart Baker to take only the first names that occur: and all of these tell their stories in a way that appeals at once and directly to anyone who has ever taken a bird's egg or held a gun.

Mr. Beebe does not succeed in making the same appeal nor does he probably desire to do so. He is writing for a public which you may call more cultured or more sentimental as suits your fancy, and he has no doubt a very wide and enthusiastic circle of admirers, and he very justifiably from his own point of view considers us lacking in the finer sense of taste, in that we should have preferred to find in his book rather less vivid word painting and a good deal more about the Natural History of a fascinating country.

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THE LATE MR. R. C. WROUGHTON, F.L.S., F.Z.S., M.B.O.U.

"It was typical of Wroughton's indomitable energy of spirit that he should, after 70, and suffering from the grave illness of which he died, have planned and started on such a monumental work as a new Blanford. But this was the key to the character of the man. No work was too laborious, too great, or too difficult for him to start on, if life were given him to carry it through to a successful conclusion."

Oldfield Thomas.

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EDITORIAL.

Mammal Survey.—We have much satisfaction in acknowledging the receipt of a grant of Rs. 45,000 from the Imperial Government of India towards the expenses of the Mammal Survey. This grant was paid to the Society in two instalments of Rs. 22,500 for the years 1921-22 and 1922-23 respectively. The Mammal Survey has been further benefited by a grant of £ 100 from the Royal Society and a donation of £ 50 from the Zoological Society of London. It is with much gratification that we record these marks of appreciation on the part of the Indian Government and the premier learned Societies of the Empire. Our thanks are also due to all those members of the Society who gave us their generous support at a time when funds were urgently needed by the Society to complete the task it had set out to accomplish.

With the financial aspect more or less assured the Society confidently hopes to complete the Survey as originally planned. Four collectors are at present engaged in the work. Mr. C. Primrose has recently completed the Survey of the Mergui Archipelago and Mr. Oldfield Thomas has written very appreciatively of his work among those Islands. Owing to the impracticability of continuing his work in Burma during the monsoon, Mr. Primrose has been transferred to Gwalior and our thanks are due to H. H. The Maharaja for permission accorded to our collector to work in his territories and for the facilities promised him. Mr. Wells is working in the Kangra District in the North Western Himalayas. His report recounting his experiences of "Scrambling over frozen snow slopes" reached us in Bombay on a particularly vicious day at the latter end of May. It is to be recorded that the temptation to exchange the office chair for a collector's gun was successfully overcome. Our third collector Mr. McCann is carrying on the Survey in the Palni Hills in Southern India. He proposes to descend to the plains during the monsoon, his future venue being the Salem and Trichinopoly Districts. The Society will be grateful to members in Southern India for any assistance they can accord him while in their districts. We are pleased further to report, that permission has once more been obtained from the Nepal Government for N. A. Baptista to resume the Survey work in that country, where Col. W. F. O'Connor, the British Envoy, has very kindly agreed to take over the work of his predecessor Col. R. L. Kennion in supervising the arrangements.

Members are aware that the material obtained through the Agency of the Survey is being worked out at the British Museum by the members of the staff and also by the aid of voluntary workers such as the late Mr. R. C. Wroughton and Mr. T. B. Fry. Mr. Oldfield Thomas in a recent letter mentioned that there would shortly be a possibility of our having to secure the services of some one who would be willing to take over the work of cataloguing and labelling the Survey material. He writes that there must be many retired officials in England, who are simply pining for the want of something to do, who would be ready to take up this work as a hobby. Whether they take up the scientific side of the work or attend merely to its routine nature, they would in either instance be doing work of much value and would be rendering a great service both to the British Museum and to the Survey. Both Mr. Wroughton and Mr. Fry came to the Museum after retirement from official life and Mr. Oldfield Thomas would be glad to hear from any of our members who would be willing to help in any way.

Bombay Fisheries.—When in 1917, the newly formed Government Department of Industries turned its attention to the fishing industry of the Presidency with a view to its development and improvement, and

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declared in its first annual report (for 1917-18) its appreciation of the need for scientific investigation, it seemed as if our authorities had at last become alive to a public duty recognised and acted upon by all civilised maritime countries, which had here been too long ignored.

A decided step forward was taken in 1918, when it was resolved to acquire a steam trawler to investigate the unknown fishery resources of the deep sea, and at the same time to secure the services of a "Marine Biologist with knowledge and experience of the scientific and economic sides of the industry, who will investigate the resources to be exploited and make proposals for the means of doing so and the necessary organisation."

The above is quoted from the annual report of the Department of Industries for 1918-19, which further goes on to say : "This is a field for Government endeavour analogous to the exploration of the country's mineral resources by the Geological Survey of India."

The Director of Industries qualifies and dilutes this point of view by adding: "In the case of fisheries, however, I consider that mere exploration work should, at the outset, be subordinated to the policy of ascertaining definitely whether trawling will or will not pay in Bombay waters. If it does pay, and perhaps even if it does not pay, there will probably be for many years to come a rich field for scientific and economic enquiry." By trawling here is apparently meant the operations of the Government's experimental vessel.

It appears to us that the Department of Industries showed an undue haste to get down to a commercial basis. Borrowing its own metaphor of the Geological Survey he would be a very short-sighted geologist who limited his attention in the field only to those minerals which could be immediately disposed of at a profit.

The fishing scheme materialised in the appearance of the Steam Trawler "William Carrick" at Bombay in March 1921, and trawling operations were begun towards the end of May 1921. The exploratory object appears from the outset to have been subordinated to the catching and landing of fish for the market. The experiment of placing trawl-caught fish upon the Bombay market was doubtless an interesting and necessary one, but it is obvious that making the marketing a primary consideration would be a handicap to systematic sea work and would make substantial inroads into the time available for the exploration of the virgin fishing grounds which are sufficiently vast in any case for a single vessel to trawl over. To put exploitation *before* exploration was on the face of it a case of putting the cart before the horse.

We are informed that the operations were not a commercial success as at no time did the proceeds from the sales of fish approach anywhere near the working expenses. It was doubtless this circumstance, in the face of the financial straits in which the Government found itself in budgeting for the financial year 1922-23, which led to the abandonment of trawling at the end of last February, after a working period which barely exceeded 9 months. It seems a sad and untimely fizzling out of a big project which must have involved the Government in a very substantial capital outlay-substantial enough to merit a longer period of activity one would imagine. Our present knowledge of the natural history of the food fishes of these parts is practically *nil* and therefore the publication of the details and the results of the work will be awaited with much interest, but it is clear that a fishery survey of the seas of a province with over 1,000 miles of coastline cannot have been carried very far in so short a period. It is to be hoped that although the Bombay Government has not been able to maintain its deep-sea trawling project—admittedly an expensive matter in the hard

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times of to-day—it will nevertheless realise that the natural resources of the sea, no less than those which flourish on the face of the earth or lie buried beneath its surface, have a considerable present and still greater potential value to the state and to posterity.

The present prospects for the continuance of fishing investigations are somewhat blank. There appears to be no provision for the appointment of a successor to the Marine Biologist who returns to England at the end of the year; and the post of Assistant Marine Biologist which was only filled for a matter of about 5 months has been abolished, one of the *minutiæ* of Government economy.

The inconclusive ending of a costly enterprise emphasises the fact that experiments of this nature are foredoomed to failure unless their conduct goes hand-in-hand with scientific investigation, and, if possible, under the direction of someone who combines knowledge of local fishing conditions from both the scientific and practical sides. We are satisfied from many facts already known that power-fishing—not necessarily steam-trawling—will some day become one of the great industries of the Bombay Presidency, and that the present setback is purely temporary and due to faults in the conception and carrying out of the scheme. What is wanted is enlightened commercial control working in close collaboration with informed (practical) scientific advice. It is evident that wide local knowledge of the life-history and habits of our food fishes is essential to ensure success. We must know at least the salient facts about them, their breeding seasons, spawning grounds, and the main factors controlling the periodic migrations that are outstanding characteristics of some of our most valuable marketable fishes. Knowledge of this description intelligently applied will assuredly enable our sea-fishing industry to develop on modern lines and so obtain the largest possible quantities of fish in the best condition upon an expenditure low enough to permit of sale at reasonable prices; perhaps in no other industry depending directly upon the spontaneous produce of Nature, can the possible result so amply repay the capital and labour expended upon it. But the practical scientist (zoologist) is essential to success and it is also needful that any extensive steam or motor fishery organization should have strong and patient financial backing and should be run in conjunction with a well-thought out and extensive cold-storage and distributing agency. It is probably an easier proposition to catch the fish than to dispose of the catches at remunerative rates. This is work that no Government department can tackle satisfactorily; Government should confine itself to the investigations that are needful to supply the data essential to commercial success and should not try directly and through their own organization to develop commercially such capitalistic methods of fishing as steam-trawling.

The Administration Report of the Department of Fisheries, Madras, by the Director, Mr. J. Hornell, F.L.S., F.R.A.I., just to hand makes very interesting reading. Although such a department should not be considered a profit-earning department, as its resources should be devoted primarily and principally to investigation and research in the interests both of the fishing industry and the general community, it manages to cover the greater part of its expenditure by profits made on the departmental tank fishery and from the improvement of inland waters. The latter source of revenue is particularly noteworthy. The Department takes over tanks and rivers from the local authorities on payment of yearly compensation based on past rentals received, and then by applying up-to-date piscicultural methods for the improvement of these waters, is able to obtain largely increased rentals, which pay all the expenses of the section and leave a handsome surplus that goes far to cover expenditure

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upon scientific investigation that is not and cannot be directly productive however valuable its conclusions may eventually prove to the industries concerned. If the Director's programme of research continues to be adequately supported by Government, about which some misgivings are felt, the operations of the Madras Department of Fisheries should become one of the greatest economic assets of that Presidency. The operations of the department have constantly expanded since its inception and include among other minor lines, a Zoological Supply section which we have much pleasure in bringing to the notice of schools, colleges and other educational establishments in India. The scheme was inaugurated by Mr. Hornell with the object of supplying schools and colleges where zoology is taught, with type and dissection specimens of our marine fauna for study in the class room. Until then, students to a large extent relied upon a study of text-book figures and had little or no familiarity with the animals themselves. They could describe a sea-anemone or a holothurian with exactitude, but would fail to recognise either if they saw it alive in a rock-pool or on the sea shore. For school museums, Mr. Hornell has had prepared wall cases of typical mollusca, crustaceans and sponges. To render these more useful, he is engaged upon the preparation of illustrated handbooks descriptive of the types represented in these cases ; the first one, dealing with South Indian shells, has just been issued and he hopes shortly to complete a companion work on the larger Indian Crustacea, to illustrate a collection of our common crabs.

Readers of our Journal will be interested to learn that Mr. Hornell has promised to write a series of descriptive papers on the common marine and fresh-water shells of India. In the present number of the Journal, we publish a paper by him on the Madras Aquarium while a future issue will contain a very interesting article on the Commensals of Indian Crabs and Alcyonarians.

Nature Study in Schools.—While on the subject of Nature Study in schools we are pleased to state that as a result of representations made by the Society Government has been pleased to appoint a Committee "to consider and report on the question of arranging for the formation, in co-operation with the Bombay Natural History Society, of a Nature Study Museum in Bombay, for the use of teachers and students of the subject." The Committee will enquire into and submit proposals on the most advantageous methods of exhibiting suitable portions of the Society's collections to European and Indian children in Government and recognised schools and will report on the best manner in which the Society can render guidance and assistance to teachers. The Committee thus constituted will also serve as a Standing Advisory Committee in future and will meet once a year to settle the lines of work. Mr. R. A. Spence has been appointed the Society's representative on the proposed Committee and during his absence on leave in England, Revd. Father Blatter, S.J., F.L.S., will take his place.

Egret Farming—In the present issue of the Journal we publish articles by Capt. C. E. Benson and Mr. Chevenix Trench, I.C.S., on the subject of Egret Farming. Members of the Society will recall the previous papers on the subject by Mr. G. Birch published in Vol. XXIII, No. 1. At the time of its publication Mr. Birch's article roused considerable comment in England, especially during the period the Plumage Bill was before Parliament. Last year a proposition was afoot for a Government enquiry into the status of these farms, particularly with a view to establishing whether cruelty was being practised. The matter however was dropped for no very apparent reason. There can be little doubt that an enquiry into this subject must eventually be undertaken. Numerous

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unsupervised farms which have sprung up in suitable localities throughout the Province and the information to hand seems to indicate that the farming of egrets on humane lines is not an impossibility and that the cruelty at present practiced could be abolished. The present method of 'plucking' as observed by Capt. Benson is both cruel and reprehensible. The suturing of the eyelids appears to be practiced only by a small section of the farmers who are compelled to transfer their establishments at seasonal periods. We once more urge upon Government the necessity of establishing the proposed enquiry. It will take time as the birds must be visited in the middle of the Sind hot weather, July-August, in the cold weather and in the early spring, but provided that the right men are sent and sufficient time given for a thorough investigation a valuable report could be obtained.

We draw the attention of members to the excellent series of articles on the collection and identification of Indian Butterflies by Col. Evans the first of which appeared in Vol. XXVIII, No. 2. Col. Evans is supplying a very much felt want, *i.e.*, a guide to the budding collector and to the recognition of the more common Indian Species. The series of articles will be illustrated with black and white photographs of various species and will be a great help to a large circle of people who are at present prevented from taking up a fascinating study for want of suitable and helpful literature. We have already commented on Mr. Hornell's proposed papers on the Common Molluscs and are pleased to announce that a popular paper, on similar lines, on Spiders and Dragonflies will shortly appear in the Journal—the former by Dr. Gravely and the latter by Major Fraser, the two best authorities on the subject in the country. The editors of the journal are doing all they can to make their publications interesting to those of their readers to whom a recondite scientific article is somewhat terrifying. At the same time the scientific aspect of our publications must be preserved. The accumulation of knowledge by the scientific worker, who places the results of his researches, in whatever seemingly unimportant sphere of study he may be engaged, within the reach of those that come after him, is helping towards the progress of knowledge and those conversant with that progress are aware that at any time some apparently insignificant discovery has thrown such a flood of light upon certain phenomena as to directly benefit the whole progress of our race.

The Society is striving to meet the wishes of all its members, novices as well as experts, and the editors will always be glad to receive from their readers any suggestion whereby this publication may be improved or in any way tend to become of greater benefit to those to whom it appeals.

Our readers are aware that this Society is almost entirely maintained out of member's subscriptions and if the high standard of its publications is to be continued the source of its income must remain unimpaired.. The recent unavoidable increase in subscriptions has been to some extent discounted by a corresponding loss of membership, and the editors hope that members will do all they can to help the Society by making its work and the advantage it offers, more widely known to their friends. A strong membership roll with constant additions to its numbers means to an amateur Society such as ours an increased vitality and a continuity of progress in the many spheres of its activity.

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MISCELLANEOUS NOTES.

No. 1.—EDITORS' AND READERS' COMMENTS ON ARTICLES AND NOTES WHICH HAVE APPEARED IN PREVIOUS NUMBERS.

The Tsaine (*Bos banteng*).

(*Vol. XXVIII, No. 2. Misc. Note No. 6.*)

In his Catalogue of Ungulate Mammals Lydekker recognises 5 races of the Banting or Tsaine (*Bos banteng*) (*Bos sondaicus* of Blanford).

The range of the animal is given as "Java, Borneo, probably Sumatra, Bali; apparently a portion of the Malay Peninsula, Burma as far as the north of Pegu and Arrakan and thence through the hills of Chittagong to Manipur, Siam and Cochin China."

The typical race (*Bos banteng banteng*) is from Java. Lydekker describes the colour of the adult bull as blackish brown to black, with face similar to the back, and the white rump patch very large and contrasting strongly with the dark area. The Bornean Banting (*B. banteng lowi*) is said to be more or less identical in colour with the Javan form.

Lydekker distinguishes the Northern races from the two above described mainly by the white rump patch which is very much more developed in the Javan and Bornean races and by the colour of the adult bulls.

In the Burmese Banting or Tsaine (*B. banteng birmanicus*) the colour of the old bull is given as "dark tawny or chestnut appearing darker in some lights than in others and shading to light brown below. Very old bulls apparently become darker". The white rump patch is described as covering a smaller area than in the Javan and Bornean races being confined to the hind surface of the buttocks and thighs.

In the Siamese race (*B. banteng porteri*) (described from two fragmentary specimens) the colour is stated to be brown, flecked with white in contradistinction to the Burmese in which the body colour is said to be uniform.

The Malayan Banting (*B. b. butleri*) is considered in all probability to be a feral race of the domesticated Bali Banting (which is largely imported into Singapore). The bulls are described as 'blackish'.

The last race mentioned by Lydekker to which no sub specific has been attached is from Cochin China.

An interesting commentary on the above might be obtained from Major (now Col.) J. P. Evans' notes on the Tsaine in his book on Big Game shooting in Upper Burma (1911) in which Col. Evans goes somewhat into detail in reference to the colouring of the Tsaine; also from a letter received from Major Stockley on the subject. Commenting on the "white rump patch" which Lydekker cites as a point of difference between the Southern and Northern races of Banting. Major Stockley writes:—

"Lydekker states that the rump patch is more developed in the Burmese, Siamese and Malayan races than in the Javan and Bornean. I am quite sure that individual variation is great in this respect and would like to know how much material he had on which to base this differentiation. I also strongly suspect that the area of white on the buttocks and thighs decreases with age, as I have twice noticed young bulls with the white area extending nearly all over the thighs: so much so that in one case, in which the bull was grazing tail on to me, I at first took him to be an animal of some new species."

As regards the colour of the body, Col. Evans, who has had considerable opportunities of observing the Burmese Banting in a wild state, is of opinion that the cows and young bulls are of a bright chestnut with a white face, white stockings and a white patch on the buttocks. "Young bulls have practically the same colour as the cows but *often have white spots in the flanks* which in

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course of time merge into each other and turn a dirty grey." Is it not probable that the white flecked colouring described by Lydekker as distinctive of the Siamese race (*B.b. porteri*) is merely the colouring of an immature animal. Writing of the Siamese race Major Stockley says :—

"As for *Bos banteng porteri*, I consider the subspecific quite unwarranted. The type specimen of *B.b. porteri* was shot by Mr. Porter on ground where several other tsaine had been shot previously, none of which had been spotted, or noted as such. I saw a photo of the specimen which was shown me by Mr. K. G. Gardiner, a keen and competent naturalist who has lived in Siam for nearly twenty years, and who doubted the validity of the race. The photo was published in the journal of the Natural History Society of Siam and showed a spotted bull with a poor head, which I would say was not quite mature, and certainly did not look to be an old animal. The spots were distributed fairly thickly over the shoulders and decreased in frequency towards the rear. The second specimen of *B.b. porteri* was shot by Mr. C. Yates at the end of March 1917, and was one of the three shot by him in that month on the same ground. Mr. Elwes was with him all the time, and himself shot a bull tsaine. Neither Mr. Elwes' bull or Mr. Yates' other two were spotted, nor were any of the bulls which Mr. Elwes had shot on the ground in previous years. It is improbable in the extreme that there could be two races of tsaine living in continuous areas of which specimens occasionally invade each other's territory. I may say that I have photos of two buck Barking Deer (*Cervulus muntiacus grandicornis*) shot in the Yamethin district of Burma in the same week on the same ground: one of them has two parallel rows of white spots on its sides, the other is quite unspotted. Will any sane person maintain that they are of different races ?"

Mature bulls according to Evans are usually yellowish brown, sometimes turning to dark grey colour on the sides and flanks. Old bulls usually have the face down to the muzzle a dirty white approaching to grey. They may be entirely grey (grey bulls according to Evans always possess magnificent heads) or the prevailing colour may be dull yellowish red (the shade of a withered leaf, or the red of old brown canvas) occasionally the colour is almost dark chocolate and rarely black (*the normal colour of the Javan race.*)

Thus we find in the males of the Burmese Banting a range of colour extending in the immature animals from bright chestnut, chestnut flecked with white to yellowish brown mixed with grey and in the older animals ranging from uniform grey to red, chocolate and black. Evans states that ordinarily in Burma the older the bull the lighter he is while Lydekker is of opinion that "very old bulls apparently become darker." Major Stockley is in agreement with Col. Evans. He writes :—

"I differ altogether from Lydekker when he states that the colour of old bulls goes darker with age. The khaki coloured bulls, I am sure, do nothing of the sort. As I have said in my original notes, I think it possible that the grey and copper-beech bulls possibly become buffalo-blue and chocolate, respectively, eventually, in some cases, going quite black; but this is merely a suggestion, and not even my opinion, as I think the matter is quite uncertain."

The question arises in the absence of complete data and material as to how far the colouration of the Banting can be made the basis for distinguishing the various races of animal. What exactly are the features or characteristics by which the various races can be recognised, as tending to become permanent forms inhabiting a definite area ?

I think that a perusal of Major Stockley's and Col. Evans' notes will show how entirely unreliable colour is as a basis for determining the races of *Bos banteng*.

Distinctions based on scanty museum material are not in many instances borne out by the subsequent observation of field Naturalists and it would be better if decisions of this nature are deferred until sufficient material and data were forthcoming. Major Stockley writes :—

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"I have protested before in the Society's journal against hasty differentiation of subspecies based on insufficient data (*vide* my notes on the horns of the Thamin) and I think that 'Wait and see' is the motto to adopt in the case of the Tsaine in this respect."

"Recent correspondence in the 'Field' has shown what a terrible muddle has been made of the Waterbucks and Kobs through Museum workers rushing to append new names to specimens with insufficient material to work on, with the result that now the genera and species are so mixed, that it is difficult to say what is a Kob and what a Waterbuck. Museum workers who do this sort of thing, put themselves in the position of staff officers who issue orders without reference to the information received from the front line, or who make no attempt to obtain such information: the result in each case is the same—chaos."

The dependence of the Museum worker on the Field Naturalist is here definitely expressed. He relies on the field observer not only for material but also for information as regards the conditions under which the species he is examining lives and has its being; including data as regards the time when the particular specimen was obtained, the locality, the altitude, and whether any variations in colour have been observed due to sex, age or season in any given district. Col. Evans and Major Stockley's notes on the Tsaine can be cited as an instance how far intelligent observation can go towards assisting in this direction.

S. H. Prater, C. M. Z. S.

Bombay Natural History Society.

Power of Scent in Wild Animals.

(*Misc. Note No* 1, *Vol. XXVIII, No.* 1.)

Major W. M. Logan Home writes:—I have read Mr. Copley's notes on "The Power of Scent in Wild Animals", in Vol. XXVIII, No. 1, with interest.

I think however most sportsmen who have done much stalking in the Himalayas will agree with me that Mr. Copley's observations on lack of power of scent in wild animals do not in the least apply to Himalayan Game.

It is well known, for instance, that bears have most remarkable powers of scent: I have known a brown bear scent me 1,400 yards off, and I have had many stalks after black bears spoilt by their getting our wind.

The same applies to Ibex and Markhor. I remember on one occasion, my shikari and I were sitting in full view of a small herd of Ibex, which were about 25 yards off and feeding past us; although several of them looked straight at us, they continued feeding until they had got round to our wind side when they suddenly snorted and rushed off downhill and I can remember many other instances of the same sort where we eluded detection by sitting motionless against rocks or trees until the beasts worked round into the wind.

I remember losing the biggest Ibex I ever saw by neglecting to properly test the wind and as the incident might be of interest I give it below:—

My shikari and I and a local Balti cooly had been lying all day on the top of a ridge watching the Ibex, 4 fine old males, and one a very big head, where shown 400 yards below us. The wind where we lay blew straight up towards us from below *from both sides* and along up the ridge.

At about 4 p.m. I told the cooly to go back to camp the path led past the position of the Ibex but was hidden from view of the animals as it lay on the opposite side of the ridge. When he reached a point to the windward of the Ibex they suddenly got to their feet and rushed madly down in a direction away from the cooly halting after going about 200 yards and gazing back in the direction from which they came.

I realised then, to my disgust, that an eddy of wind had come round the ridge and carried the cooly's scent to the Ibex. The latter made off right across the valley and I saw them no more. The cooly was in my view all the time and was

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quite hidden behind the ridge. Col. Kennion in his fascinating book, "Sport and Life in the further Himalaya," relates a similar incident where the changing of the wind in the middle of the stalk lost him a big head.

Comparison of Tiger and Panther Skulls.

(*Vol. XXVII, No. 4, Misc. Note No. 2.*)

Mrs. Maxwell writes:—

"It may be of interest in connection with the photographs of skulls in the journal of 31st July 1921, page 934, to see a photograph of two tiger skulls, the occipital condyles of which rest on the surface of the table, and to know that four out of eight tiger skulls in our possession have the occipital condyles in contact with the table."

We have examined a series of 24 tiger skulls in the Society's collection and find that in 7 skulls the occipital condyles were in contact with the surface on which they were resting. The remainder were raised above. It would appear from this, that, as a point of difference between Tiger and Panther skulls, Blanford's test would be of little value, since the above mentioned character is to be observed in the skulls of both animals, though possibly to a less extent in the Tiger.

B. C. Ellison, C.M.Z.S.

Panthers and Artificial Light.

(*Vol. XXVIII, No. 1, Misc. Note No. 2.*)

Mr. R. C. Morris writes:—With reference to the note under the above heading written by Mr. C. B. Beadnell, the following account should be of interest:

In February 1921, my wife and I were sitting up over a "kill" in a shola. Soon after dark I decided to test the electric light apparatus and found that it was not working. There was no time or light to see what was wrong, and whistling for our sholaga shikaris, I instructed them to tie up a hurricane lamp over the kill. While they were doing so the panther came to the edge of the cleared patch round the kill and slunk back into the shola on seeing the men. I had to call out to the men, who had not seen the panther, to clear out. A few minutes later the panther walked out into the full light of the lantern and started his meal and paid the penalty for his daring. Another panther was killed, and yet another was missed, in lantern light last year on these hills and I know of no other instances.

An instance of the extraordinary cunning of panthers is shown by the following incident:—

Recently my wife's favourite dog was killed by a panther and we sat up over the kill until it began to rain, when we decided to return to our bungalow. My wife did not like the idea of the panther turning up and devouring the dog's remains in our absence and so we had the carcase put up on the machan. On our visiting the spot the next morning we were astonished to find that the panther had climbed up on to the machan and had devoured the remains of the dog. The machan was a considerable height off the ground.

Living a life in the jungle one sees or comes across many strange and exciting jungle incidents and tragedies. Perhaps the most extraordinary sight that I have ever witnessed was the killing of a solitary bull bison by a solitary elephant.

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Bird Collectors in India.

(Editorial, Vol. XXVIII, No. 1.)

Dr. C. B. Ticehurst writes :—

With reference to the letter of Capt. Livesey quoted in your last editorial, and your remarks on his impossible scheme, I should like to say a few words. The impression given is that India is swarming with bird collectors, out to get any rare and beautiful plumaged bird they see. Broadly speaking, of course, there is no such thing as a rare bird, all being as common as Nature intended them to be, if looked for in their true habitation, that, however, is by the way. But where are all these collectors Capt. Livesey complains about ? I should be glad to know as with so much yet remaining to do in India they should be encouraged. When I was in Sind I knew of *three* (besides myself) all doing valuable work in parts little or not known, there may have been others I did not hear of, if so, they remain silent judging by the papers which have in the last few years appeared in the Journal. But since I left India, it appears, collectors have greatly increased in number, I rejoice to hear it, as doubtless now there will be no difficulty in obtaining *desiderata* which we in England are handicapped for the lack of ! If Capt. Livesey will give us a list of collectors and their districts we can then inform them through the Journal what specimens are required thence for the British Museum, and the Curator of our Society could add *his desiderata*.

Now as to his scheme, in the first place the Society surely has no power to prohibit " the slaughter of rare and beautiful birds." This can only be done by an Act and the " Prohibition of Export of Plumes Act " gives protection against slaughter for trade purposes. Without a very wide and very special knowledge of the whole of the birds of India, which no single man possesses, no one can lay down the law as to what should be the limits in collecting. Capt. Livesey suggests a typical series of skins of each species by which of course he must mean a series from the type locality, a very desirable object which neither the Bombay nor British Museum has attained as yet for every Indian *species* even. And what of races ? Still less are these collections representative.

To avoid collecting birds on the fringe of their distribution pre-supposes a pretty exact knowledge of the range of every species and race in India, and entails far more collecting yet ; the results when obtained would take the most skilled worker years to work out. No ! In my opinion Capt. Livesey has started at the wrong end and the required knowledge for his diagrams does not exist. As regards publication of diagrams, 12-15 quarterly, by the Society giving such information as we possess up to date of geographical distribution, is it suggested that each Indian species should be put on one of these ? That is taking the number as in the Fauna as 1617 (and it is many more now), is the work to be spread over 27 years, and who is to prepare this almost life's work ?

There is one suggestion, however, which I can find myself in agreement with and that is the publication of a list of " wants ". I should not bother about " do not wants " as no well made skin with full data of practically any Indian bird from anywhere would ever figure among the " do not wants " at any Museum ; I should confine " do not wants " to scraps without data. I began a list of " wants " last year with an appeal for nestlings of any Indian birds, a subject on which we know *nothing* (see B. N. H. S. J., XXVII, p. 931), an investigation any egg collector in India (and in my day they far out-numbered skin collectors) could help with, but up to date as a result I have received *one* specimen.

I, and no doubt others, who work at the British Museum would send along lists of " wants " for various localities if there was any chance that the wants would be supplied. For example, certain birds are wanted, all common enough, from some locality between Benares and the Vindhya Hills—say the area, Saugor-Jubbulpore-Ramnagar—as it was from this area Franklin described a good many

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birds, but even to this day specimens thence are very poorly represented in the British Museum. If any response is forthcoming I shall be pleased to supply the names of the actual species. Collecting without method provided birds are collected properly is not a waste of time or bird life, though I quite grant more could be done if collectors knew what was particularly wanted in their area, but they must make themselves known first.

Birds of Mesopotamia.

(*Vol. XXVIII, No.* 1, *page* 222).

In Dr. Ticehurst's "Birds of Mesopotamia" published in your last issue, he omits perhaps the one and only interesting fact in the nidification of the Hooded crow (*Corvus cornix*) in Mesopotamia, which is, that in the absence of date palms it will nest in the dense reed beds (Hamar Lake).

Kotah, Rajaputana, T. R. Livesey, Capt.
25*th February* 1922.

Notes on Lizards, Frogs and Human Beings in the Nilgiri District.

(*Vol. XXVIII, No.* 2, *page* 493.)

A parallel to Col. Wall's interesting researches into the habits of Reptiles and Amphibians in the Nilgiris published in Vol. XXVIII, No. 2, of the Society's journal may be found in an interesting article published in the September issue of the Magazine of Natural History (Journal of the American Museum of Natural History). Mr. Kingsley Noble, Curator of Reptiles in the American Museum of Natural History, recounts the methods employed by him in his attempts to discover the life histories and habits of the reptiles and amphibians, especially the remarkable frogs of the Andean region. The most interesting of these is the Marsupial Frog the female of which is provided with a pouch in which she carries the eggs until well developed. In the pouch the young are reared until an advanced stage in the tadpole existence. Many interesting details in the life history of this Frog remain unsolved. Little is known about its habits, its pouch, its egg laying and the manner in which the egg reaches the pouch which, by the way, is situated on the frog's back. It was towards helping to solve some of these problems that Mr. Noble particularly directed his efforts. Col. Wall spent much time and patience in discovering that, the little "castanet" Frogs were the authors of the "Clap like sounds", which every visitor to the Nilgiris during the rains is familiar with. Mr. Noble's methods may therefore commend themselves to the gallant Colonel or anyone desirous of following in his footsteps. Mr. Noble writes: "There is only one way of delving into the home life of a frog, *i.e.*, to steal upon him at night when his amorous calling betrays his place of hiding. With an electric flash light the task is easy for the frog seems to be as little concerned over one's presence as he is over the fire flies which flit across his world. His callings, love making, nest building, may be examined in as great detail in the open as in his structure in the laboratory. It was obvious that if we were to investigate the marsupial frog into revealing any of his great secrets it would have to be done at night." Recounting his experiences Mr. Noble writes:—

"I started off alone toward a bannana patch where I had heard the previous evening the hammering of a dozen carpenters. There was something about the quality of the hammering which told me the 'Carpenters'

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were not human. I thought of the carpenter frogs which come to our Jersey pine barrens in the spring. These are of a different family and their hammering has a clattering, less deliberate ring. The New Jersey 'Carpenters' always sound to me like a crowd of boys laying shingles, while the clear measured clap of these hammers could be compared only with that of a skilled workman.

First I followed an old agave-grown wall, then another stone wall running to the bannana field. It was a different world at night. My light fell first upon a giant centipede, more than eight inches in length, putting into service every one of its many legs for a rapid escape up the trail. Numerous jewels shone on the periphery of the light. Some of these on investigation proved to be nothing but drops of water, others of a deeper glow were the eyes of spiders. A little farther on a glimpse of two close-set headlights, followed by a creature's wild rush through a thicket, told me that I had disturbed an opossum in its nocturnal wanderings.

The hammering became much louder as I approached the bannana patch. I realized that the hammerers were not all in the bannana plants; some were in the old stone wall, and others in the agave plants. I started toward one of the performers, but another calling nearer at hand turned me aside, and before I had fairly well started, it seemed much easier to run down a third. It was only after I had concentrated my entire attention on the pounding of one of these Huancabamba 'Carpenters' that I had any success at all, and then it seemed so easy. The performers were not the least disconcerted by the spot light."

No. II.—JUNGLE NOTES.

The Tiger making the "Sambhar Call."

Mr. Hugh Copley writes to us on the above subject as follows:—

"When away on Christmas Camp and enjoying the blaze of a jolly fire we heard the call of a sambhar which every night came to drink below us within half a mile followed by the tiger 'sambhar' call if I might call it so. The sambhar and the tiger called after each other for ten minutes during which time we had called up two Bigas who confirmed each call as it was made.

Now the call although alike (and would be sworn to as alike by the average man) is not so by any means. Firstly the sambhar call is higher in pitch, more musical and also shorter and finishes clear. The tiger 'sambhar' call is lower, more chesty, and not clear cut. This call given by itself might easily be mistaken but the two calling together educated the listener to the difference very quickly.

It is known and proved by experiments that the ear drum of man has by evolution changed considerably since the time we were cave men, and is rapidly (used in its correct sense with reference to evolution) changing to receive wave lengths of much shorter length, such as the noises of civilisation heard towns, so that we cannot, as we once did, receive and interpret lower or longer wave lengths. You have only to see bush tribes (hunters) in Central Africa at work, to realise how they receive and interpret lower wave lengths. Now the same thing occurs in a much greater degree with animals and I doubt very much if any animal mistakes the sambhar call for that of the tiger 'sambhar' call. Therefore this call is not used by the tiger with any idea of luring the poor unsuspecting sambhar to his doom. Secondly it would be a cute animal to lure a C.P. sambhar to any doom. This view is also held by the Bigas.

It therefore must I think be a mate call but this will be a very difficult thing to find out."

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Mr. Dunbar Brander writing to us in regard to this says :—

"The tiger's noise is a mate call pure and simple, although very like a low sambhar bell no sambhar would mistake it. I have had a tiger make it at me when I walked him off his kill in long grass and he thought I was his mate."

Major C. H. Stockley gives us the following experience :—

"Walking along a forest track in upper Burma in July 1914 about 11 a.m. I came to a small tract of open tree and grass jungle bordering a deep ravine into which several small gullies ran from my direction. From the direction of the ravine I heard what I took to be a sambhar call, when I was only 40 yards from it. I walked towards it hoping to see a stag, when suddenly the call came from a small gully 15 yards away. I could not see the bottom but it looked much too small to hold a sambhar. I moved cautiously forward and found it was only three feet deep with a sandy bottom in which were the pug marks of a large tiger : the sand was still running down into them. I followed them to the main ravine and found the tiger had then galloped off along the bottom. I surmise that he had heard me coming along the track, called, and then sneaked up the gully towards me thinking it was game (a cow tsaine perhaps) approaching, discovered his mistake and bolted. The call was quite possibly to attract his mate."

Lt.-Col. R. W. Burton *in epistola* says on this subject :—

"That tigers make a 'Sambhar-like-call' has been noticed in the Journal of the Society (Vol. XXI, page 235) by writers from both India and Burma. *Vide* Vol. XXI, page 235, where Major H. H. Harington writes that it is a well known fact in Burma that tigers often 'call' like a sambhar and he gives an experience of his own. Mr. J. W. Best also relates an occasion on which in the Central Provinces of India he actually saw a *tigress* making a noise which he at first thought to come from a sambhar. Mr. Copley now writing from the Central Provinces describes the 'call' and gives an interesting description of it as compared with that of the sambhar, both being heard at the same time, and thinks it must be a 'mate' call.

I have on two occasions heard tigers make the 'Sambhar-like-call' (1912 Eastern Ghats) and agree with Mr. Copley that the call would not, probably, deceive an animal. No doubt the denizens of the jungle very readily recognise it for the imitation that it is : but Mr. Copley's conjecture as to its being a 'mate' call is not borne out by the circumstances related by the two writers previously quoted. So far as I know there was no tiger any where near when I heard the 'call' which was several times repeated and it seemed to be a 'hunting' note : perhaps tigers think themselves to be better mimics than they are.

It may be that animal curiosity causes sambhar to tarry in the vicinity and so enable the questing tiger, having 'called' in one direction, to slip round and gain a nearer approach.

It is not difficult to call up 'Kakur' (Muntjac) by means of a blade of grass or a leaf placed between the thumbs and blown upon edgeways. Moose are 'called up' as is well known. Certain tribes in India—snarers of animals—can call up jackals to within a few yards. Such incidents can be added to from many parts of the world, so why should not the tiger have acquired the habit of calling up a prospective dinner or at least inducing it to stay a while from headlong flight.

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Probably sportsmen with wider experience than mine may be able to offer more definite information. It is curious that Mr. Inverarity and Mr. Reginald Gilbert, have made no mention of this habit in their various exhaustive articles in our journal: neither so far as I can call to mind have any other writers."

The papers by Mr. Inverarity and the late Mr. Reginald Gilbert which Col. Burton refers to are evidently the following:—Sambhar and Sambhar Stalking by J. D. Inverarity, Vol. VIII, p. 391, and an article with the same title by Reginald Gilbert published in Vol. III, p. 224. We give particulars of the journal in which they appeared as some members who do not possess the earlier numbers of the journal might like to obtain them.

Sambhar Swinging by their Horns.

In regard to this Mr. Copley writes:—

"Not long ago I was watching a fine Cheetal Stag with attendant ladies grazing under a 'ber' tree which at this time of the year has a plum like fruit. This was as usual a pretty jungle scene, but what particularly interested me was the fact that several times the stag got up on his hind legs and swept his horns through the branches of the 'ber' tree knocking the fruit to ground. Then quite bucked with the performance he ate, but would not allow the does to do so. Does this bear on the above question? Might a sambhar also brushing off 'ber' fruit get caught like Absalom? I cannot think that pleasure is expressed by males more than females. My experience is (certainly when watched, in big herds) that the females are always up to pleasure, generally being very skittish, and female sambhar who are apt to play much more than their lords and masters cannot try swinging for pleasure so why should the stags? So if the kind gentleman who next finds the swinging places of sambhar stags will kindly tell us the name of the tree, heights, etc., we shall be much more nearer the truth."

Mr. Dunbar Brander comments as follows:—

"The sambhar stands right up on his hind legs during the rut and remains so quite a time. In doing so he not infrequently gets his horns over an overhanging branch; the tree may be of any species—he is not after food."

Lt.-Col. Burton in his letter quoted before writes:—

"The legend of sambhar swinging by their horns as a pastime has not come to my notice either among the Marias or other jungle people with whom I am acquainted."

Duck and Snipe in the Central Provinces.

Can any of our members in the Central Provinces answer the following question by Mr. Copley?

"Where are the duck and snipe this year in the Central Provinces? From all the different districts I have had no news, neither have I seen them myself. North, East, West and South they are absent, even in places which unlike this blessed place, have full tanks and have had plentiful rain during the season."

Will members of the Society, wherever they may be stationed, send us copies of their Game books for the past season? In Mr. Kinnear's days we tried to collect such information and though we had fewer replies than we anticipated, the replies received were of considerable use to Mr. Stuart Baker and the authorities at the British Museum. For the majority of our members such reports. elaborated a little with personal notes on the shoots recorded, will be of considerable interest. We do not ask our correspondents to give away their favourite shooting grounds, the district is all that is necessary for record purposes.

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A summarised account of the cold weather season 1921-22 shooting in India and Burma, if only the response to this appeal will make it comprehensive enough, will be of benefit to members and perhaps be the means of increasing the membership of the Society. We ought to have far more members than we have but we fear some consider the journal "too scientific". There should be no reproach in our journal being scientific. It is the scientific papers which have made and do make it so valuable but in view of papers such as the above, the article on 'Butterfly collecting in India' by Col. Evans, Major Stockley's papers, and so many others, is there not sufficient matter of interest for the most unscientific "shikari ?"

No. III.—THE INDIAN LION.

A few months ago a lion was shot in the main street of the small and semi-deserted village of Shergarh in Kotah State. I have been able to obtain possession of the skin—or the remains of the skin—which I am sending to the Society as a donation from the Maharaj Kumar Saheb of Kotah. A lioness is reported to have been seen in the same vicinity. Rumours of a lion having been seen at Sawai Mahdopur, just north of this State, were current about a year ago.

With regard to this skin, I have endeavoured to discover—in vain—where this lion came from. It is said that the lions liberated in Gwalior some years ago were all accounted for, though it would be as well to get this confirmed or contradicted.

The only other lions I have heard of were a pair liberated in Bundi some 10-15 years ago. According to some accounts both these beasts (which are said to have come originally from Kotah) were shortly afterwards found dead ; according to others they were not seen again. It is just possible that they bred. Perhaps some member of the Society will be able to supply some information which will help to clear up this somewhat mysterious occurrence of a lion in Rajputana.

That lions were abundant here in the old days would seem apparent, for they are frequently depicted in the stirring shikar scenes which decorate the old Palaces, taking precedence as Royal game, over even the tiger.

In conclusion I may say that the skin is a small one—apparently a male lion 2 or 3 years old. We are trying to obtain the skull but it has probably been broken up and disposed of.

T. R. LIVESEY.

KOTAH, *March 21st*, 1922.

No. IV—THE OCCURRENCE OF THE STRIPE-BACKED WEASEL (*MUSTELA STRIGIDORSA*) IN THE NAGA HILLS.

I write to report the occurrence in this district of *Mustela strigidorsa*, which as far as the authorities to which I have access go, has hitherto only been reported from the Himalayas. I was driving in a motor car in this district at a height of about 5,000 feet when the car had to be stopped to avoid running over two small animals fighting in the middle of the road. In spite of the fact that they were almost touched by the front wheel of a very ramshackle and noisy Ford, they continued fighting within a foot of the car, and the battle progressed for some minutes alongside the foot-board and eventually worked across the road into the gutter on the far side, when I got out to watch it at close quarters again. The bigger of the two was an enormous rat, probably a bandicoot or something

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very like it, while the smaller, which could not have weighed more than a third of its antagonist, was a weasel. I was able to observe it very closely. The body was about 11 or 12 inches long and its tail 4 or 5. The hairs of the tail were bristling out at right angles to the bone, and were shorter towards the tip. The general colour was a deep ruddy brown, with hint of something almost purplish in it. The chest and throat appeared to be lighter and yellowish; there was no black tip to the tail; from the neck right down the back, nearly to the root of the tail, ran a narrow white line, so clearly marked as to appear artificial, as though put on with paint. The head was that of a typical weasel, with the eyes set very much on the surface and looking like protruding black beads. The weasel had the rat by the muzzle, holding on like a bull-terrier, and kept pulling him down, when the two would roll over until the rat managed to stagger to his feet again, when the process recommenced. The rat was obviously being worn out, as he was unable to run when the weasel let go (which he did not do till I was stooping over and almost touching him), while the weasel was able to run off exceedingly briskly. I have never seen this weasel before, and a Kuki who was with me said that it was unknown to him also, though he was a native of the district and an intelligent jungle man.

J. H. HUTTON.

KOHIMA, NAGA HILLS,
15*th January* 1922.

No. V—THE TENASSERIM TREE-SHREW (*TUPAIA BELANGERI*).

As this little beast is plentiful in the area I am working in and as hitherto tree-shrews have been looked upon by me, and I have no doubt the same applies to many of our members, as quaint rarities, I made it a point to try and learn something about it and I hope these notes may be of interest.

The first thing I noticed about this little animal was the fact that it must have been named "tree-shrew" by some learned naturalist when feeling in a sarcastic mood, as, though an inhabitant of heavy and medium forests, up a tree is the last place I should advise a collector to search for it. Having learnt a good deal about this animal I should advise any one finding a tree-shrew up a tree to treat it exactly as recommended in the case of weasles caught asleep. So far as I have been able to observe, the tree-shrew is wholly diurnal in its habits but, being a confirmed skulker and an exceedingly timid one at that, it is not as commonly seen as one would expect from the numbers caught in traps. Its movements remind one forcibly of the days when, due to ground being under enemy observation or to points where snipers sniped from, one moved in the same way. Sitting perfectly quiet in the jungle after an absolute silence of perhaps a minute or two, one hears a slight rustling coming from a dense patch of tangled creepers messed up with a large fallen branch on one's left. Very very gradually you turn your head towards the sound but, just as the spot comes into view, all sound ceases. You turned the least little bit too quick and have been spotted. You continue to stare hard at where you think the last sound came from but see no sign of animal life whatever and then a brilliant idea strikes you. "Confound it, it must have been one of those lizards that are always poking about under leaves" but just as you are thinking of taking a look up at the trees a "tch tch" comes from the old spot. More eye strain and once again no sound but, this time, you know that it is a bird, one of those wee ground babblers, and you are determined to spot it. Patiently you stare at the mass of creepers, working from right to left, from top to bottom and *vice versa* but no! not a living thing can you see bar red ants on that tendril, and if you can see them your sight cannot be so bad. You decide to rest your eyes for a few seconds and then to have another look so you take a glance up at

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that creeper bedecked tree as being a likely place for a squirrel. Hardly have you focussed on the creepers when there is a scurry from the old spot and you are just in time to see something small and brown disappear into a patch of undergrowth some three or four yards to the right. Once again you freeze and stare but this time, just as your eyes are beginning to smart, there is a jump, jump, and you see something small and brown among leaves of the same colour, but it might be anything. Then once again there is the "tch tch" and a little brown beast starts to move, lifting each foot carefully and with its tail all of a bristle and "half cocked" if I may use such an expression. "Tch Tch Tch Tch" it calls and with each sound the tail gives a twitch. It has now reached the edge of the cover and is deciding whether the next cover can be reached in one or two short sharp rushes. Its mind made up, it streaks across the open in a series of rapid jumps. Not half away across it spots you and becomes suddenly motionless, all four feet together, back arched and tail inclined almost parallel to its back. Thus it remains for a few seconds, too terrified to think properly, then making up its mind to chance it, it dashes across the remaining distance to cover. Curiosity is said to have done down the cat but the tree-shrew, in common with all living creatures, has its full share and if you remain quiet you will see that this is so. There! it jumped on to that creeper and is now behind that leaf. Another jump and it is in full view directly facing you. Its head now starts to bob up and down in a hawk-like fashion and its tail, all a bristle, twitches simultaneously. It has settled in its mind that you are only a stump so hops along among the creepers and is on to the ground again nosing among the fallen leaves for insects. It pauses a moment with head bowed and mouth open while with one paw it picks its teeth. While doing this one might almost imagine it a miniature mongoose, in fact in many of its movements there is something very mongoose-like. Just when you are getting really interested in watching the little nerve ridden beast a squirrel gives the warning "hawk over" and the tree-shrew darts back into cover again.

Though I never came across the young and am unable to give information as to the time of year in which they are born, I found that the adults were courting in January. During the period of courtship the tree-shrew is more in evidence though not, as I found, so often trapped. Love evidently abolishes hunger! The males as far as I could judge positively refuse to take NO for an answer, though whether like some married men, they afterwards wish to goodness they had, I know not. I watched for a considerable time a couple chasing around and while the chase was in progress an occasional shrill twittering cry would come from them both, no doubt meaning something as different in each case as the sex which uttered it. Eventually (feeling no doubt exhausted) the female jumped into a creeper about two inches off the ground and turned facing the male. Though I was within a few feet of the pair I heard nothing beyond an occasional very low chortle but the tails of both kept up a continual twitching and doubtless that, and facial expression were ample language for the occasion. When the lady was rested she fled, screaming in the same shrill twitter "I loathe you, nothing will ever induce me to become your wife." "Consent is the least part of it" was the reply as her lover scampered after her and I thought at the time of an old song, in regard to a persistent lover, entitled "The villain still pursued her."

The tree-shrew is an exceedingly agile little beast and can, like a mongoose, jump with the same rapidity backwards, sideways or forward. Being very tenacious of life quite a number escape from the traps and the more badly injured ones may sometimes be found at a little distance from the traps still endeavouring to get away. I find that it is a good thing to look for blow-flies in a case where an animal has escaped as, if it is unable, as is often the case, to do more than crawl, these flies get busy on it and I think it is beyond doubt that where these flies are, something dead or smelly or both will be found.

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Tree-shrews eat fruit picked up off the ground as well as insects, as an examination of their interior economy shows.

From the article which appeared in the last number I gather that Mr. Fitzpatrick is a keen collector of animal folklore stories and if he wishes to add to his collection I have the true story as to exactly how the tree-shrew came about and why he is, what he is, a little brown, furry, longnosed, nerve ridden beast. Unfortunately the Editors tell me it is too long for inclusion here.

C. PRIMROSE.

MERGUI,
20th March 1922.

No. VI—FOUR-HORNED FAT-TAILED SHEEP.

Can anyone tell me whether they have seen alive or dead a fat-tailed sheep with four horns? I came across a passage in a book called a Summer in High Asia (Thacker 1899) by Capt. Adair, late Rifle Brigade. He says on page 199 that he saw in the possession of two travellers (mentioned only as "P & C") who had wintered in Yarkand and were bringing down some fine heads of *O. poli* from the Pamirs, where they had been deserted by their coolies in attempting to cross the Mustagh Pass, a four-horned sheep, one of the fat-tailed, from the Pamir. In addition to its ordinary ram's horns it had two horns rather like those of an Ibex, but straight and some 20 inches in length. It was quite tame and would eat from the hand. I possess the head of a four-horned ram from Kishtwar and have seen others from various parts of China but none of these were fat-tailed sheep and if such a thing now exists in any museum or collection I should be very glad to procure a photograph or measurements of it.

H. J. ELWES.

COLESBORNE, GLOS., ENGLAND.
7th January 1922.

No. VII.—DESTRUCTION OF BIRDS' NESTS.

We publish below a number of letters received in response to Mr. R. C. Bolster's appeal for information on the above subject:—

It is with interest that I have read Mr. Bolster's account of mysterious disappearance and destruction of nests. This must be very common in India and has been noted by several people. Colonel Butler in the seventies recorded that if a nest with eggs was left for future visit, they always in the interval disappeared. During 2½ years in Sind I only remember one nest which on being left came to anything, and that was a nest of the Indus Sand-Lark, which I spotted as I was riding across the Desert and looked at without dismounting. Every other nest disappeared, or at least, the eggs were taken; I have even known a nest from which I had taken the eggs completely vanish.

I think that there are several causes, firstly in many places, unless very lonely spots, there is a native about, and his curiosity, natural at all times, is aroused by the (to him) strange behaviour of anyone interested in natural history, and one is constantly being watched; when the coast is clear, he goes to see what the *sahib* was doing and takes the eggs of larger birds for food, and smaller ones possibly, I fear, from spite.

Round Karachi I know crows and heron's eggs were always taken, but there are other enemies to small birds, and I think Mr. Bolster is quite correct in accusing lizards, but the worst thief of all is the House Crow. In the nesting season I always had a flock following me about all day in the cultivation and I am certain they watch one's doings with an eye, to future evil intent: so certain was I that they did this, that I have fooled them by being very interested in nothing

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in a likely bush, and have afterwards seen them fly to the bush to investigate. Other enemies to ground birds are Kites and Desert Foxes. I have seen the foot-prints of Kites at a nest of Saunders' Tern, which the day previous held eggs, and I have found Fox " spoor " in amongst the colony after I had visited it, and, here again I was watched or more probably tracked by this very inquisitive little animal. Snakes too, may be guilty, but whether a nest is found or not there is a huge destruction by nature. One colony of Saunders' Terns owing to big tides and depredations of animals did not produce a single flying young, one year, and a colony of Sandgrouse, about 50 pairs, did not raise six young; think what it would be if every bird brought out a full brood every year and none died for ten years. For a lecture I once gave at Karachi, I calculated the effect in the case of the House Crow and I estimated that in this town, every available inch of space, houses, ground and trees in Karachi would be covered with birds, and above them a huge black pall of those which had no room to settle!

LOWESTOFT, ENGLAND,
18*th March* 1922.

CLAUD. B. TICEHURST, M.A., M.B.O.U.,
Late Capt., R. A. M. C.

In an article on ' Birds and their enemies ' in a recent issue of the "Pioneer" Mr. Dewar answers a question which is very often asked.

My experience added to this might serve to throw some light on Mr. Bolster's ' Destruction of Birds ' Nests ' which appeared in the last Volume XXVIII, No. I of your journal.

The hot weather is come and with it have returned a number of my feathered friends who spent the summer with me last year: the bulbul, the tailor-bird, the honeysucker and the brown munia are here again seeking to build nests, strange to say, about the same places where three out of the four pairs unsuccessfully kept house last year.

For years I had noticed the destruction of nests as described by Mr. Bolster, and only last year I discovered the cause. I watched a tailor bird build its nest in a vine which overhangs my study window and later I saw one of the birds sitting in the nest which I one day noticed contained three tiny eggs. Two or three days after I answered their calls of distress and arrived in time to drive off a tree pie which had torn one side of the nest and dislodged two of the young. With a needle and thread I repaired the nest and replaced the little ones which I was glad to see take wing a fortnight later.

On two other occasions the cries of the munias which had built in a creeping rose hard by my verandah steps, and of the bulbuls which had taken possession of an aralia in my verandah, brought me out; and on each occasion I saw the same bird rifle the nests.

The honeysucker's nest was destroyed in my absence but I have no doubt *Dendrocitta rufa* knew something about it.

Another thief is the Crow-pheasant or mokok (*Centropus sinensis*) I saw him carry off a dove's egg which he placed on my lawn and which I rescued before he had time to begin his meal. But it was no use, he had dented the egg in the act of carrying it.

I had often noticed the mutri and the mokok hopping through the whole length of a hedge row and only last year discovered what their object was.

Yes, garden lizards are responsible, not for the destruction but for the rifling of many a little bird's nest. In the one instance which came under my observation the eggs were eaten in the nest and the shells left. I saw the lizard leave the nest.

LUCKNOW,
27*th March* 1922.

T. DE GREYTHER.

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Having read Mr. R. C. Bolster's note on the above subject, I am tempted to send observations made by me from time to time which I hope will be of some interest.

During the months of May and June 1918, having time to spare, I gave a good deal of it to searching for nests with the view to finding out what is roughly the percentage of success in birds bringing out their young. The difficulties were far greater than I had expected but I give in the following list the results. The nests were visited by me frequently, but not daily and I always went unaccompanied, so that no human being knew of these nests, so far as I am aware.

From the tables on the adjoining pages will be seen that 27 birds laid 77 eggs; hatched 39 young, but only succeeded in taking out 26. The percentage of success is roughly 33 per cent. The members of the genus *Lanius* were most successful and reared all their young. This no doubt is due to their pluck in keeping off despoilers. Only in two cases were the robbers actually caught in the act and in both instances they were Jungle crows (*C. macrorhynchus*), but I would not place all thefts to their account. The greatest sinner in this respect is *Dendrocitta rufa* (Scop). (The Indian Tree Pie) and the destruction caused by this bird is appalling.

I have noticed these birds for several years now and only wonder that any nests of the small birds escape destruction. Whether they feed their young on the eggs and young of other birds while they are nestlings I cannot say, but they certainly do so after the brood is able to fly. For the past few years a pair of *D. rufa* have visited this place accompanied by their brood, from two to four almost full grown youngsters, and have made a systematic search of all the trees and bushes in my garden. It is generally in early July that they come, and it is also just about the time when most birds have eggs or young. During these visits I have always found that all the nests have been cleared out, and no matter how well a nest may have been placed, it never escaped destruction

During August 1919 I had over a dozen nests of Weaver Birds (*Ploceus baya*) (Blyth) under observation. These nests were hung from some thorny bushes a few feet from the ground. I visited these daily and on 14th August noticed that some had young, as the parent birds were busy feeding them. The next day on my arrival I found the whole family of *D. rufa* (two parent birds and three young) engaged at the nests and were just finishing their work of destruction. They had torn a hole in each nest sufficiently large to admit their heads just at the spot where the nest bulges and had extracted and devoured the contents. I have little doubt that the monitor lizard (*V. bengalensis*) referred to by Mr. Bolster does a great deal of mischief, but I have only once seen him swallow the unfledged young of a Sun bird (*Arachnecthra*). The nest was hanging from a creeper just outside my window and on noticing that the birds were alarmed I looked out and saw him with one in his mouth which he proceeded to swallow alive. I hastened to the nest but was too late as the young had all gone.

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Name of Bird.	Date.	Position of Nest.	Clutch.	Hatched or not.	Remarks.
1. *Arachnecthra asiatica* (Lath), Purple Sun Bird.	12–5–18	3 ft. from ground in a rose bush.	2 eggs.	No.	1 egg found in nest on 20th, none on 26th.
2. *Terpsiphone paradisi* (L.), Paradise Flycatcher.	12–5–18	5 ft. from ground in a Lichi tree.	4 eggs.	No.	Nest empty on 13th. Saw a crow leave the tree.
3. *Arachnecthra asiatica* (Lath)	14–5–18	5 ft. from ground in a creeping rose.	3 eggs.	No.	Nest destroyed on 27th. Not known how.
4. *Terpsiphone paradisi* (L.) ..	14–5–18	20 ft. from ground on a Tun tree.	3 eggs.	Yes, 2 young.	Nest found destroyed on 30-5-18.
5. *Zosterops palpebrosa* (Temm.), Indian White-eye.	17–5–18	4 ft. from ground on a Lichi tree.	3 eggs.	Yes, 3 young on 19–5–18	Nest found empty on 21-5-18.
6. „ „ „	18–5–18	8 ft. from ground on a Plum tree.	3 young, a few days old.		Nest found empty on 19-5-18.
7. *Terpsiphone paradisi* (L.) ..	20–5–18	15 ft. from ground on a Mango tree.	4 eggs.	Yes, 3 young.	Took out all three which kept near the nest for a few days.
8. *Dicrurus ater* (Herm.) Black Drongo.	21–5–18	20 ft. from ground on a Tun tree.	3 spotted eggs	Yes, one young 28–5–18	Took out one and this a cuckoo.
9. *Lanius erythronotus* (Vig). Rufous-backed Shrike.	22–5–18	12 ft. from ground on a Mango tree.	6 eggs.	6 young on 24–5–18	Took out all six. Were seen near the nest for two days

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Name of Bird.	Date.	Position of Nest.	Clutch.	Hatched or not.	Remarks.
10. *Zosterops palpebrosa* (Temm.)	22–5–18	6 ft. from ground in a creeper.	3 eggs.	No.	One egg only on 27–5–18. Nest destroyed on 3-6-18.
11. *Acridotheres tristis* (L.) Common Myna.	23–5–18	12 ft. from ground, in the crown of a Date palm.	Not known.	No.	Nest destroyed by crows and the eggs carried off in my presence.
12. *Zosterops palpebrosa* (Temm.).	23–5–18	13 ft. from ground on a *G. robusta* tree.	3 eggs.	No.	Nest destroyed.
13. *Oriolus kundoo* (Sykes), Indian Oriole.	24–5–18	16 ft. from ground on a Mango tree.	3 eggs.	Yes, 3 young on 31–5–18	Young taken by crows on 7–6–18.
14. *Copsychus saularis* (L.), Magpie-Robin.	24–5–18	12 ft. from ground on a beam under the eave of my house.	2 eggs.	No.	Birds driven off by a pair of Mynas, *A. tristis*.
15. *Lanius vittatus* (Val), Bay-backed Shripe.	27–5–18	7 ft. from ground on a Mango tree.	2 eggs.	Yes, 2 young.	Took out both.
16. *Molpastes intermedius* (Hay) Punjab Red-vented Bulbul.	4–6–18	7 ft. from ground in a Plum tree.	2 eggs.	2 young on 12-6-18	Took out both.
17. „ „ „	13–6–18	9 ft. from ground in a bunch of Plantain fruit.	....	....	Nest deserted on 17-6-18.
18. *Lanius erythronotus* (Vig.)	16–6–18	15 ft. from ground on a Mango tree.	5 eggs.	Yes, 5 young.	Took out all five.
19. „ „ „ ..	25–6–18	10 ft. from ground on a Mango tree.	2 young found.	....	Uncertain as to whether they succeeded in taking young out.

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Name of Bird.	Date.	Position of Nest.	Clutch.	Hatched or not.	Remarks.
20. *Pyctorhis sinensis* (Gm.), Yellow-eyed Babbler.	16–6–18	5 ft. from ground in a bush.	3 eggs.	No.	Eggs destroyed on 21-6-18.
21. *Zosterops palpebrosa* (Temm.)	23–6–18	2½ ft. from ground in a Lime tree.	3 eggs.	Yes, 3 young.	Took out all three.
22. *Dicrurus ater* (Herm.)	1–7–18	25 ft. from ground on a Mango tree.	1 young found.	Yes.	Took out this one.
23. *Halcyon smyrnensis* (L.), White-breasted King-fisher.	14–6–18	In a hole in a bank.	5 eggs.	Yes, five young on 25-6-18.	4 young found on 26-6-18. 3 young found on 29-6-18. Took out these three.
24. *Rhipidura albifrontata* (Frankl.), White-browed Fantail Flycatcher.	28–5–18	10 ft. from ground on a Jamun tree.	3 eggs.	....	Destroyed by a storm on 3-6-18.
25. „ „ „ ..	24–6–18	8 ft. from ground on a Mango tree.	2 eggs.	No.	Nest destroyed on 1-7-18.
26. *Orthotomus sutorius* (Forst), Indian Tailor-bird.	30–6–18	1½ ft. from ground in a leaf.	4 eggs.	No.	3 eggs destroyed on 7-7-18. Nest deserted.
27. *Franklinia gracilis* (Frankl.), Franklin's Wren-Warbler.	5–7–18	„ „	3 eggs.	Yes, all three.	Nest empty on 21-7-18.
			77	39	26

DEHRA DHUN,
March 16th, 1922.

O. C. OLLENBACH, F.E.S.

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No. VIII.—ON THE HOMING FLIGHT OF THE COMMON HOUSE-CROW (*CORVUS SPLENDENS*).

A friend of mine has recently furnished me with a most interesting account of an extraordinary flight of Common House-Crows (*Corvus splendens*) which he witnessed not long ago. As I have not had a similar experience, nor do I know of anyone else who has, I give below a brief description of what my friend saw. There are, possibly, some members of the Society who may have noticed a similar flight of crows, and if so, it would be interesting to know what explanations they have to offer as to the cause or causes of such flights. I understand that there is no record in our Journal, so that this note may be of some interest. Some who read this note will perhaps think that the facts are greatly exaggerated, but I am satisfied that there is very little, if any, exaggeration.

While undertaking a railway journey between Lahore and Ambala on the 14th January this year a large number of common house-crows was observed moving in the same direction as the train between the stations of Goraya and Phillaur. The most noticeable feature about this flight was the number of birds seen. My friend states that the crows were at least "ten deep" that they were *in a solid phalanx about three miles in length*, and that the number of crows he saw must have run into *tens of thousands*. The birds were all flying in one fixed direction, *viz.*, from North-West to South-East, and appeared to be coming in the direction of Phillaur from some point North-West of that station. The birds were close to the train and were flying parallel to it, sometimes very near to the carriages and sometimes a little distance away. The height at which the crows were flying was estimated at about 40 feet approximately, as they were above the tops of the trees (keekur and babool) growing in that part of the country through which the train was passing; the rate at which the crows were flying was estimated at 15 miles per hour; and the manner of their flight was a steady flapping. It is stated that some of the crows seemed to be slowing down and gave the impression that they had flown for a considerable distance. This idea was apparently a correct one, because along the whole route many trees were covered with evidently tired birds. The time at which this extraordinary flight of crows were seen was between five and six o'clock in the evening. The atmospheric conditions were: an overclouded sky, a low temperature sufficiently cold to make one close the windows of the railway carriage, and a cutting breeze from the North.

My friend is quite certain that the birds he saw were common house-crows (*C. splendens*), and further, that there were no other kinds of crows (*e. g. C. macrorhynchus*) or, in fact, any other species of birds which formed the enormous flock.

The above are the main facts concerning this curious flight. What were the causes which led to it? I cannot offer any explanation which I can say is correct. I am inclined to think that this flight was due to migration, which in turn was probably caused (?) either by (*a*) sudden change in climate in the place from which the crows were coming, or (*b*) lack of food-supply in that place. These seem to me to be *obvious* reasons which would explain why the flight was undertaken, but can there be any other causes, and if so, what are they? The facts that the crows were flying in such numbers, were all flying in one direction and in a fixed manner, were slowly slackening in speed, and were resting on trees *en route*, all point to migration. I do not think that it can be said that the crows were going to roost. Is the common house-crow a recognised migratory species in the sense that some ducks are? Is it even a locally migratory species? I should think that lack of food-supply would not have a strong influence in the distribution of so ubiquitous and omnivorous a species. Again, is it possible for the climate in a particular area in which crows are found to suddenly change in such a manner as to drive out the *crows* from that place?

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Suppose we reject the migratory theory: what other theory could be advanced in support of this flight of crows in such large numbers? If we must retain the migration theory, then can it be said that crows are a non-migratory species?

DELHI, 22*nd February* 1922. S. BASIL-EDWARDES.

We submitted the above Note to Mr. H. Whistler who writes as follows :—

"I have read with care the note on a flight of crows which you have been kind enough to send me for perusal. In my opinion the writer's friend saw the flight as described by him, and the species was correctly identified. The flight was undoubtedly only the usual evening flight of *Corvus splendens* to its roosting place, which is a very familiar sight in portions of the Punjab. I am unaware whether similar flights occur in other parts of India, but in the Punjab they are noticeable in certain areas, where a suitable roosting place collects the birds for miles, around. These flights occur both in summer and winter, and the loitering about on the route (the "tired birds" of the writer), is a characteristic of the flights. There is no question of migration and no question of food supply involved: had the writer passed the same way on other evenings he would have seen similar flights."

A reference to similar flights is to be found in the Ibis, 1916, p. 42.—EDS.

No. IX.—THE WHITE-THROATED GROUND THRUSH (*GEOCICHLA CYANONOTUS*) AS A MIMIC.

On the 28th January 1921 it was my fate to be abroad at 3-30 a.m. As I was returning to the bungalow at dawn, I observed a White-throated Ground Thrush (*Geocichla cyanonotus*) perched on one of the lower branches of a leafless rubber tree, beside the road. It was singing, and one so seldom hears its pretty song that I stopped to listen. I could hardly credit the evidence of my own senses, for out of that ground thrush's open mouth poured forth the clear rollicking whistle of a spotted babbler, followed by a Nilgiri babbler's song, then came a much poorer attempt at a racket tailed drongo's bell-notes and finally its own tune was resumed.

A. P. KINLOCH, F. Z. S.

NELLIAMPATHY HILLS,

1*st February* 1922.

No. X.—THE OCCURRENCE OF THE BLUE-BEARDED BEE-EATER (*NYCTIORNIS ATHERTONI*) IN THE C. P.

In the Fauna of British India this species is stated not to have been reported either from Central India or the Central Provinces.

In a list of the birds of Pachmarhi recently published in Vol. XXVIII, No. 2 of the Society's journal I stated that I had heard on one occasion in the vicinity of Pachmarhi the characteristic guttural call of this bird, but that I had failed to see the bird. Such evidence was, to say the least, unsatisfactory.

I am glad to be able to report that I have quite recently watched a pair of these birds at close quarters at Nimbu Bojh within a mile of Pachmarhi, so that the occurrence of this bird in the Satpura hills is now an observed fact.

PACHMARHI, C. P., B. B. OSMASTON, I.F.S.

16*th January* 1922.

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No. XI.—NOTE ON NIGHTJARS IN THE CENTRAL PROVINCES.

With reference to Mr. B. B. Osmaston's notes on Indian Nightjars I am able to supply the following authentic instances of Nightjars in the Central Provinces. The specimens themselves are all available for examination in the Nagpur Museum:—

FRANKLIN'S NIGHTJAR (*C. monticola.*)

No.	Sex.	Locality.	Date.
767	♀	Mouth of Tawa R. near Hoshangabad	25-1-1918
807	♀	Gothangaon, Bhandara District ..	3-5-1920
27	♂	Nagpur	16-3-1911
74	♀	,, ...	16-5-1911
626	♂	,, ...	15-6-1914
402	♀	,, ...	22-8-1912
516	♂	,, ...	29-8-1913
783	♂	Nagbhir, Chanda District	13-12-1918

COMMON INDIAN NIGHTJAR (*C. asiaticus.*)

307		Sawargaon, Chanda District	17-3-1912
781	♀	Nagbhir, Chanda District	12-12-1918
753	♀	Kampa, Chanda District	16-12-1917
756	♀	,, ,, ,, ...	18-12-1917
757	♀	,, ,, ,, ...	19-12-1917

HORSFIELD'S NIGHTJAR (*C. macrurus.*)

259	♀	Sumnapur, Baihar Tahsil, Balaghat District.	16-1-1912

We have a clutch of *C. asiaticus* from Saugor and there is a clutch from the Bilaspur District sent in as belonging to the Jungle Nightjar by Mr. Dunbar Brander.

Clutches of *C. monticola* have been taken by Mr. D. MacArthur in the Nagpur and adjacent Districts.

C. monticola, which is the common species at Nagpur, has a peculiar call resembling "wakh, wakh,—wakh wakhoo". Whether this call is uttered in the breeding-season only I am not quite sure.

CENTRAL MUSEUM, NAGPUR.

E. A. D'ABREU.

23rd January 1922.

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No. XII.—THE FOOD OF THE SHIKRA (*ASTUR BADIUS*).

On the morning of 6th February a Shikra caught a little Indian Kingfisher under a babul tree 4 or 5 yards from me. The kingfisher gave the shikra a useful peck but the latter was just attacking the former's throat when I ran up and the shikra let go. The kingfisher flew off apparently unharmed. Somehow one does not connect a kingfisher with the idea of game for a small hawk. I felt rather virtuous at having saved the kingfisher from its cruel enemy but I smiled afterwards at my hypocrisy as I was on my way to my stand for a duck shoot.

I see the *Field* has been giving instances of a variety bag with one shot. I got a quail and a field rat on the 3rd with one shot which seems unusual.

E. O'BRIEN, Lt.-Col.

Bhuj, Cutch,
8th February 1922.

[The usual food of the shikra appears to be lizards, but it is not averse to seizing small birds, rats or mice, or even large insects.—Eds.]

No. XIII.—THE MARBLED DUCK (*MARMARONETTA ANGUSTIROSTRIS*) IN THE PUNJAB.

From what is said in Stuart Baker's Game Birds of India, Burma and Ceylon (Vol. I, page 242) regarding the distribution of the Marbled Duck I gather that records of its appearance in the Punjab may be of interest.

I have shot single specimens of this bird in the Punjab on four occasions:—

15th November 1908 28th February 1909	Ferozepore District.
20th November 1918 1st November 1921	Jhelum District (on the salt lake at Kallar Kahar in the Salt Range, altitude 2,100 feet.)

H. W. WAITE,
Indian Police.

Jhelum, Punjab,
24th March 1922.

No. XIV.—THE OCCURRENCE, HABITS AND BREEDING OF THE SPOTTED SANDGROUSE (*PTEROCLURUS SENEGALLUS*) IN THE BAHAWALPUR STATE, PUNJAB.

The spotted Sandgrouse (*Pteroclurus senegallus*, Blanford) is, within my experience at any rate, sufficiently uncommon in the Punjab to justify my writing to you to record the fact that Col. O'Brien and I have recently shot it in this State.

On one occasion these sandgrouse (the only kind of sandgrouse about) were from 200 to 300 in number. The weather here has been rather unusual (cool and rainy) which perhaps brings these birds.

After writing the above I have had further opportunities of observing these birds and I am now able to give a definite assurance that this species breeds here also.

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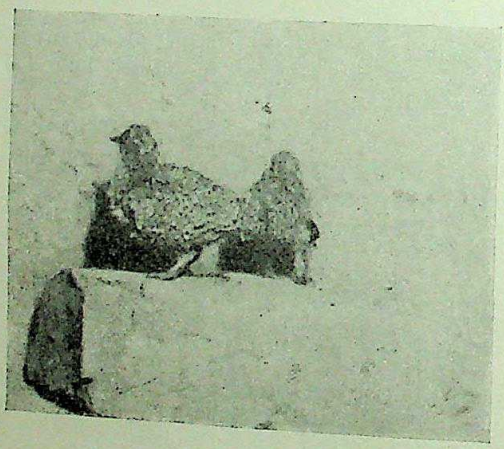
On the 7th current I was driving in a car through the desert at a place about 10 miles West of Ahmadpur East with a companion when I noticed a bird on the ground that seemed worth investigation. It was late in the afternoon, but we got out and looked. The bird proved to be a Sandgrouse, and, on approaching nearer, we saw that there were two. Then a second pair came in view and, by the time I looked at the first pair again, I found there were with them a pair of young ones about one-third their size, but well able to move on the ground. This was distinctly interesting, both because the date struck us as early for any Sandgrouse to be breeding and because we had both heard a note which assured us that this was *senegallus*, and were near enough to identify the colouring. We have both shot the spotted Sandgrouse recently and his note cannot be confused with that of the black-bellied *Pterocles arenarius* or the common *Pteroclurus exustus*.

The old birds with their young ran on ahead of us, and the tactics of the old ones were perfect. There was only one tiny bit of cover in the near neighbourhood in this waste of hard wind-swept clay, *viz.*, a thin strip of dwarfish bush not more than a few inches high. In this the parents left their babies, while they themselves ran on ahead and went through the most approved decoy antics. We were not deceived however and proceeded to hunt for the nestlings, which were soon found squatting very close with heads drawn in and looking exactly like the bits of dry camel dung which are to be found about. My friend stalked one little bird and caught it successfully in his hand, the infant not moving till it was secured. The other, either alarmed at the fate of its companion or because more advanced (there was a distinct difference in size between the two), got up as I approached and ran off, flapping its immature wings, but I secured it. There seemed a very good chance of our being able to bring the chicks up, so we determined to take them back with us. This we did, the old birds flying round us most persistently till the last.



These nestlings were densely covered with yellowish down of a most completely protective colour. My photo shows the two side by side on a brick of regulation size.

The day but one after, I went out and spent an hour and a half quartering the ground in the neighbourhood with a rope. I saw a flock of 14 of the same

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species, but got no nests or eggs. Numerous smooth hollows in the ground hereabouts however were filled with convoluted droppings which I suspect to be those of this species. Their number seems to suggest that the birds may sleep, as the Common European Partrige is said to do, in parties heads outwards, tails inwards, for purposes of protection, but it is a point which I have not verified by personal observation. The nestlings were alive on the 10th April, and the man in charge of them, who has much to do with the care of domestic fowls, reported that they were doing satisfactorily, though he had to feed them by hand still. I then had to go away for several days and was distressed to find on my return that both had died. The precocity of the Sandgrouse and their congeners among "nidifugous" birds is well-known. I should imagine that these youngsters were a week to ten days out of the egg when we found them.

The place where our find was made is not less than 30 miles from the River Indus, which with the *jheels* and ponds near it, is where our winter species drink. This bears out what Stuart Baker has to say about the distance these birds breed away from water. How then are the young birds given the liquid they require? A recent book of a type more scientific than it affects to be, *viz.*, Pycraft's "History of Birds," says that the parent Sandgrouse, after slaking their own thirst at distant water, wallow till their under-plumage is laden with water, which they are able to convey, after the long return flight, to their young. Regurgitation, as with other kinds of birds, is perhaps a means of providing liquid or food of a semi-liquid kind.

A last point for notice is that the chicks were able to give the call-note of the species,—which may be rendered "*whit-hu*", perfectly. It is not difficult for a human to mimic, and I could get the youngsters to answer me when I tried it on them. Stuart Baker gives the Sindi name as *Gutu*, which is no doubt onomatopoeic like the Vernacular names for the commoner kinds of Sandgrouse that I am familiar with in the Punjab.

DERA NAWAB N. W. R., R. C. BOLSTER.
BAHAWALPUR STATE,
19*th April* 1922.

No. XV.—CROCODILE SHOOTING AND SNARING.

(With a plate.)

Mr. Shortt's good article was enjoyable reading.

My own shooting has been confined entirely to Sind, and to crocodile in jheels, "dunds" we call them here. A year ago I spent a week at a group of "dunds" in the neighbourhood, they were full of mugger, but the beasts difficult to shoot as the shores in most places were open maidan, with no cover excepting where too thick to penetrate. All the shooting had to be done on the same side, as the crocodile stalked was lying, as the water was too wide to fire across. As a result of some years' experience at this sort of shikar, I have formed certain theories, and my methods of stalking are based on these.

The occasion here related was the first shoot of sufficient length I had had, to give my methods a really good test.

I may first of all say that I have never been successful in approaching mugger over open ground unless the wind was in my favour, excepting for odd animals sound asleep. I have frequently noticed that sheep, goats and cattle, however much noise they made when feeding naturally, and not galloping about in fright, never sent mugger into the water. I found that by getting on to my hands and knees at a long distance from the mugger, and appoaching

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in a more or less irregular and zig-zag fashion avoiding a straight line, and pausing at intervals in the manner of a feeding animal, I could get easily within 40 or 50 yards.

Previously I always used a H. V. magazine rifle, and relied more on the force of the blow at a longer range. When I discovered that by adopting the tactics described I could get up to a much nearer range I experimented with a lighter weapon, much easier to handle and with no recoil and little noise, and which I could use much more accurately. I found, that provided the right spots, as described in Mr. Shortt's article were reached, the result, H. V. or Low Velocity, was much the same. The mugger was either killed or more frequently knocked out sufficiently to allow him to be secured. In addition to the advantages the light rifle mentioned gives, one gets infinitely more chances of shots, and provided the securing and despatching is done with little noise it is very common to find another candidate waiting round the next bend of the shore. During the first day's shooting I secured 14 skins and actually had 5 lying on the shore in different parts of a large "dund" awaiting the skinners, who were very much overworked that day!! I got 42 skins in the week, average 8 ft.

I take with me four men, two of them are Bhils, for skinning. These two follow me, keeping out of sight all the time in the jungle, until called up by a whistle The chief assistant follows me, stalking as I do, and at a few yards distance behind me. The second keeps well behind. If the stalk is successful everything is done as quietly as possible, without shouting, or loud expressions of satisfaction, and when the dead mugger is drawn up the beach to be skinned out of sight, I am ready to continue. I have often been amused at the gathering accompanying some sportsmen I have seen at work. There is nothing a mugger hates worse than a durbar, and no wonder that many people find they are hard to get under such circumstances.

Curiously enough I have never seen mugger come up again after being wounded, excepting for one that I hit and for some reason he could not submerge.

I have known them come out to die often enough, and one I remember came out half an hour afterwards, right to my feet. In the dunds I speak of they are all of the blunt nosed variety (*C. palustris*), rarely over 12 feet, though in a certain "dund" I know of, entirely surrounded by high sand hills, there are 5 or 6 big Gavials (*G. gangeticus*), all about the same size, 14 feet, judging by one I got.

I have heard it said that Gavials cannot climb over these hills and go from dund to dund the way the other kind do. If this is so, it is interesting to speculate how they got there, or if they were imprisoned by the sand hills forming, as they do very quickly about here.

I have been unable to find any reliable information regarding the age of crocodiles, and as they grow so differently under different conditions I think it must be impossible to tell.

Once when fishing, I hooked and played and eventually landed a small Gavial, 2 ft. in length. He gave excellent sport, and just as I got him to the bank exhausted, a large turtle came up and bit off a forefoot. I kept him alive in a tank for some months. I have thrice hooked big fellows while fishing, but they have simply lain like logs and worried the cast through. A friend shot one, in the act of swallowing a wild cat, which was quite fresh and had presumably been seized while drinking.

There are two methods known to me which are practised in Sind, by which mugger are taken alive. The first which I have not actually witnessed myself is as follows.

The water must be shallow enough to allow men to wade, say up to their necks. A man goes out on a hollow copper pot, the usual way of crossing water

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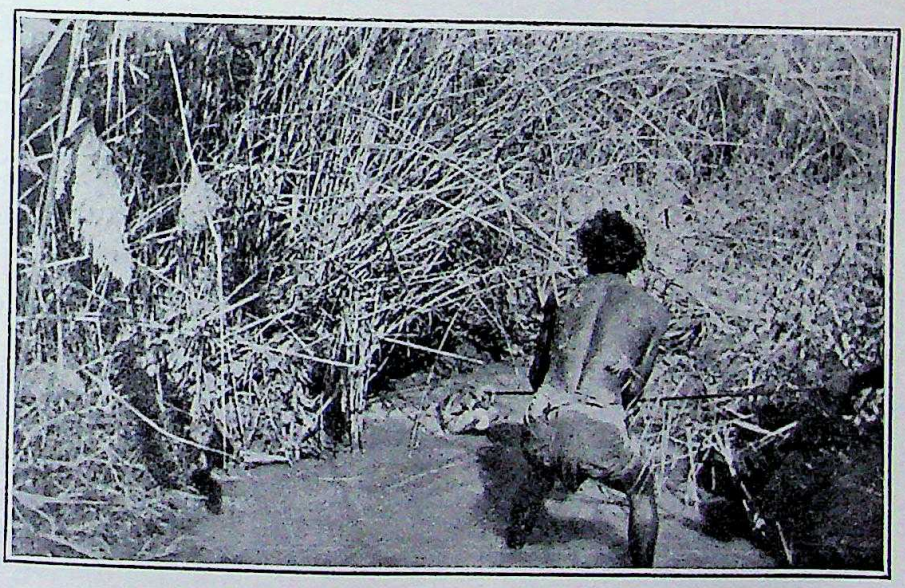
Tying a rope round the mugger's neck after the hand net is in position



Pulling the reptile out of the water.

CROCODILE SNARING IN SIND.

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about here. He locates a mugger lying in the mud at the bottom, and places the stick he carries on the animal's back, which remains motionless, for some reason or other. Other men then come into the water, and duck under and get a rope round him, and he is then pulled out.

The other method I have seen. When the river water recedes the dunds are partially drained through narrow channels. Mugger wandering at night take refuge in the deeper spots in these channels and are tracked there. The first step is to burn away all overhanging grass and bushes, as the brute is invariably lying in a hole under the bank, head outwards, and under water of course. His head is located by a stick and a small hand net is placed over his head. I have never quite understood the reason of this, as it would be of no use to hold him or to protect the men. I believe that when a crocodile feels any pressure on his body or head he is disinclined to move, possibly through fright.

Another man then gets into the water and with the head actually touching him, and facing him, ties a rope round the mugger's neck, or forelegs.

Until pulled to the surface he makes no movement of any kind, and the whole proceeding is the tamest and most unexciting affair imaginable.

A wounded mugger is another proposition and feared by the men who do this work.

Regarding the treatment of skins, I have found that they will keep indefinitely it put into a pit in the ground after being well cleaned and kept in brine.

Though the Railway do not accept wet skins it is possible to pack them while wet into a packing case and send them in this way.

I attach two photographs showing the second method of catching crocodile alive, and it will be noticed that the lower jaw of the animal depicted has been shot away partially at some time. We also found a number of hard lumps in which we expected to find bullets, but they only contained hard black sand or something similar.

"SIND."

2nd February 1922.

No. XVI.—FOOD OF THE FAT-TAILED LIZARD (*EUBLEPHARIS MACULARIUS*).

As very little is known of the food of Indian Lizards it may be of interest to record that the Fat-tailed Lizards (*E. macularius*) living in captivity in the Society's rooms feed very readily on any Lizards introduced into their cage; a young skink (*Mabuia carinata*) and a common blood sucker (*Calotes versicolor*) were both very easily accounted for. On one occasion an immature Fat-tailed Lizard (*E. macularius*) met with a similar fate.

The two lizards have lived in the Society's rooms for the past 5 years. They were presented by Capt. W. B. Cotton from Wano Waziristan, and until quite recently they lived almost exclusively on Spiders and Insects, chiefly grasshoppers and cockroaches, and could even be tempted into eating the crumbs of a biscuit. Their vision by day strikes one as being rather defective as it is constantly noticed that they make several aimless snaps at food which is literally under their noses; this was strikingly displayed in the case of a skink who, hemmed in a corner by one of these lizards, repeatedly wriggled into safety owing to the blundering tactics of its pursuer. These lizards betray an extreme ferocity in attack, one of them sprung from the ground on to a branch about 8 inches overhead in an attempt to secure its victim. Since writing the above the writer introduced a scorpion into the cage occupied by the lizards. It was immediately seized and swallowed, repeatedly stinging

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its attacker about the head and lips during the process. The lizard paid not the slightest heed to these demonstrations on the part of its victim, but swallowed it in a few gulps and seemed none the worse for the experience.

BOMBAY NATURAL HISTORY SOCIETY, S. H. PRATER, C.M.Z.S.

16th May 1922

No. XVII.—THE SENSES OF A SNAKE.

The sight of snakes is not good in the day time even in the case of diurnal snakes with round pupilled eyes. Those snakes that stalk their prey instead of waylaying it, do so chiefly by means of the tongue. The two branches of the forked tongue, flickering up and down, come in contact with the two footprints of the animal or reptile stalked and then dart up to its own nose, each branch conveying to one of the nostrils the scent of its prey.

If a snake is watched stalking prey which it cannot see, in long grass for instance, it will be noticed that it follows the exact course, no matter how twisted, of the creature it is after, which proves that until the prey is sighted the snake depends on scent and not on hearing.

It is uncertain whether the tongue of a snake is able to sense a scent spoor itself, or whether it is entirely dependent on the nostrils of the snake to do this; at any rate the tongue appears to act as the carrier of the scent to the nostrils.

If the tongue itself could sense a scent spoor, it would no doubt receive it in the form of taste. It is, however, doubtful whether a snake possesses much, if any, sense of taste. Several instances have been reported, and I have seen a few cases myself, where snakes in captivity have seized and swallowed cloths, and, in one case even a stick, which had previously come in contact with, and absorbed the scent of rats, which the snakes, relying chiefly on their sense of scent, mistook them for. It must, however, be admitted that in all such cases I have heard of, the snakes in question have been Pythons, which, being nocturnal snakes, with eyes adapted for night work (*i.e.*, elliptic-pupilled), see badly in the day-light.

One of the most notable examples of such an accident, was the case of a Python at the London Zoological Gardens which seized and swallowed a rug. I do not know whether the snake was misled by feeling or by scent in this case, but it helps to show that snakes possess little or no sense of taste.

A snake's tongue appears to act as a guide as well as a scent carrier, playing the same part as whiskers do in a cat. As, however, a snake is not totally blind and only bad sighted, it is curious that it uses its tongue as much as it does, when not hunting.

Possessing no external ears, even in the form of ear-holes, the hearing of snakes is bad. Sounds appear to be conveyed to it chiefly through vibrations through the ground, and it is easily disturbed by footfalls, while often remaining deaf to louder noises above ground level, and I have found that it is possible to approach closer to a snake without alarming it, when walking on a ground level above it, as for example walking on the bund of a paddyfield when the snake is lying below the bund.

A. F. ABERCROMBY.

TRAVANCORE.

12th July 1921.

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No. XVIII.—PEARL BEARING MUSSELS.

Mr. Laird Macgregor recently forwarded the Society a small packet of Pearls produced by a species of Mussel found in a tank at Badas a few miles from Belgaum. Two examples of the Mussel were sent with the packet. Mr. Laird Macgregor wrote:—"I do not suppose the pearls are of any value, but is it not rather unusual to find pearl bearing mussels in fresh water?"

The mussels and pearls were sent to Mr. Hornell, Director of Fisheries, Madras, for investigation and Mr. Hornell has sent in the following interesting remarks in connection with them.

"The shells are of the common fresh-water mussel, probably *Lamellidens marginalis*. This species is often very abundant in fresh waterponds and streams and it is not uncommon for it to produce pearls. The quality is usually poor on account of the small size, poor lustre and frequent colouration. But when the mussels occur in large numbers and when they produce pearls freely, their collection is remunerative; such small pearls should fetch about Rs. 10 per tola weight and there is always the chance of finding a large pearl of fair lustre that may command a price of anything up to Rs. 50 or possibly even more. At Surada in Ganjam, fresh water Mussels producing pearls are so abundant that the villagers collect them for this purpose and their pearls are often to be had in the village bazaars. Similarly in Bengal there is a well-known Zemindari fishery for these Mussels farmed out, I believe, by the Zamindar for a considerable sum.

Curiously enough these Mussels vary greatly in their pearl-producing quality. In some localities, pearls are so seldom formed that collection of the Mussels is wholly unremunerative. This is due to the fact that the formation of pearls in these animals is due mainly to the presence of certain parasites. If these be absent, as in most localities, the Mussels produce few or no pearls; if they be numerous, we may then expect pearl production to be abundant.

The famous Scots pearls celebrated in the middle ages are produced by river-mussels closely related to those sent to me. As is well known these pearls are occasionally of considerable value. But they are distinguished by a pink tint which diminishes their market value. Those sent from Belgaum are similarly tinted. Several of these fresh-water pearl fisheries are still worked in the north of Scotland. Some Welsh streams also produce pearl-bearing Mussels.

In North American rivers, the fishery for fresh-water mussels is a big industry employing hundreds of workers and a large capital. But while pearls are occasionally found of some considerable value, this fishery is conducted primarily to obtain mother-of-pearl for the pearl button factories. These consume many tons of these fresh-water Mussel shells.

In India, this same industry has arisen in Bengal, where supplies of a species of *Lamellidens* are found in the rivers, sufficiently stout to permit of poor quality shirt-buttons being cut from the shell. I believe it might be worth while to examine the streams and large tanks throughout the Bombay Presidency in order to ascertain if any species exists here with shell sufficiently thick and in good abundance, for if there be, then further quantities might be cultivated and the material sold for button making.

Streams draining from or passing through a limestone region are the most likely to produce thick-shelled Mussels. Here in Madras, the streams are generally deficient in carbonate of lime and so our Mussels are almost wholly too thin shelled to be utilizable commercially."

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No. XIX.—AN UNUSUAL SWARM OF MOTHS.

The Society recently received a number of moths which were said to be swarming in very large numbers round the cantonments at Amballa. Lt.-Col. J. Patterson in forwarding the specimens wrote :—

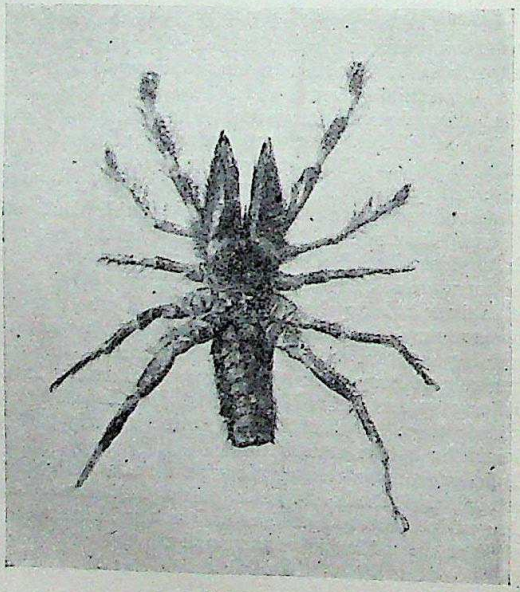
"Numbers are found every morning in dark corners, such as behind pictures, inside topees, behind almirahs, curtains, etc. They get into strange places such as chests of drawers, the only way to which is by entering at the bottom of the chests of drawers, and passing up between the back of the drawers and the back of the piece of furniture. I do not think they can breed out in the drawers.

I have asked the inhabitants here and they say that they have never seen anything like these numbers of moths."

The moths were examined by Mr. T. R. Bell who identified them as follows:—The moth is *Agrates flammatra*, Fabricus; in England it is called the Black-collar and is very rare. It is there known as *Noctua flammatra*; I believe its new generic name is *Rhycia*. I do not know anything about the local food plant but it is probable that it feeds upon any low plant. The food plant in Europe is the Dandelion, *Taraxacum densleonis* and Strawberry (*Fragaria*). The larva is certain to pupate underground in the earth like others of the type. In some years it is certain to find that certain species of moths turn up in enormous numbers even though, ordinarily, they may be scarce. It depends mostly, I think, on absence of Natural enemies (Ichneumons, etc.) combined with suitable climatic conditions.

No. XX.—OCCURRENCE OF THE GALEOD SPIDER (*RHAGODES NIGROCINTUS*) IN THE SOUTH ARCOT DISTRICT, MADRAS PRESIDENCY.

(*With a photograph.*)



It may be of interest to your readers that a male specimen of *Rhagodes nigrocintus* (*Galeodidæ*, Arachnida) was obtained last September at Gingee in the South Arcot District of this Presidency.

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The interest of the specimen lies in the fact, I believe, that it is the second specimen of the species on record and the first male specimen. The female specimen through which the species is known is recorded from Vellore and is in the British Museum (*vide* J. B. N. H. S., Vol. IX, p. 452). The present specimen is in the Indian Museum.

I may state that I am confirmed in my identification by Dr. Gravely of the Madras Museum.

DEPARTMENT OF ZOOLOGY, S. G. MANAVALARAMANUJAM.
MADRAS CHRISTIAN COLLEGE,
29*th July* 1921.

No. XXI.—A CASE OF PLANT SURGERY.

There is an old gigantic Baobab tree (*Adansonia digitata*) probably more than 300 years old, since the offenders sentenced to death at the time of Alli Adilshah, were executed on this tree (Bijapur Gazetteer,); for which reason the tree is still known as "The Execution Tree".

The tree has a very thick stem with a girth of 49 ft. at 3 ft., 50 ft. at 6 ft., and 58 ft. at 10 ft. from the ground. The largest measurement of *Adansonia digitata*, as stated by W. B. Bannerman from Madras in 1904, is 48'–2".* The tree divides into 3 huge branches at about 10 ft. from the ground. The whole tree covers an area of 10 gunthas. Thus it presents a huge appearance in the compound and attracts the notice of every passer-by.

Being old, this tree was naturally attacked badly by rot and the main trunk near the base, where there was a hole, and the whole of the heart of tree had disappeared.

Being afraid of losing the tree, Mr. Elliot, the District Judge, first applied to the Private Secretary to His Excellency the Governor of Bombay for steps to be taken to rejuvenate the tree. The correspondence was forwarded by the Director of Agriculture, Bombay Presidency, Poona, to the Economic Botanist to the Government of Bombay, Poona, and I was deputed for the work.

Being encouraged by the successful results of similar work done on Casuarina and other trees in the Ganeshkind Botanical Gardens, Kirkee, I went there and observed the tree. In the base, a hollow was found of the dimensions of 15 feet by 17 ft. It was conical in shape. The following operations were made during the first week of September 1920. The hollow was filled in with rubble and mud and concreted over. The affected parts were first cut out and it was found that the rot was due to the grubs of a large beetle. Hundreds of these grubs were cut out of the tree. As soon as the wound edges were cut down to sound wood, the wound was tarred over and then filled in with concrete. All other parts which showed signs of attack or susceptibility to it, within a short time were tarred over and any spot where water was likely to lodge was filled in with concrete.

The District Judge was pleased to remark in his letter, dated the 10th February 1921, addressed to the writer as follows:—

"The result has been a most workman-like job and the tree this year, though a famine year, at once reacted by producing a far finer foliage than was noticeable the year before. The whole job has been satisfactorily done and attracted a large crowd who had never seen such a surgical operation on a tree before."

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* Journal, Bombay Natural History Society, Vol. XV, p. 718.

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Within my knowledge this kind of operation has proved successful on the following trees in the Deccan :

Names :—

(1) *Garruga pinnata.*

(2) *Casaurina equistifolia.*

I recommend this treatment with confidence to the attention of those who have an interest in saving their old mango and other trees.

POONA,
January 1922.

L. B. KULKARNI, M.A.,
Assistant Professor of Botany.

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PROCEEDINGS

OF THE ANNUAL MEETING HELD ON THE 27TH FEBRUARY AT THE PRINCE OF WALES MUSEUM.

The election of the following 7 members since the last meeting was announced:—Capt. C. P. Hancock, Bombay; Capt. J. L. Longbottcm, Bombay; Rev. J. C. Hall, Ahmednagar; Mr. W. W. Clifford, Nadiad; Mr. G. C. Phillips, Bombay; Mr. P. G. Glendinning, Moulmein; and Mr. R. M. Crofton, I.C.S., Amraoti.

COMMITTEE OF MANAGEMENT.

The following gentlemen were elected as Office Bearers for the present year :—

PRESIDENT.

H. E. Sir George Lloyd, D.S.O., G.C.I.E.

VICE-PRESIDENT.

Mr. J. D. Inverarity, B.A., LL.B.
The Hon'ble Sir Norman Macleod, Kt.
H. H. The Maharao of Cutch, G.C.S.I., G.C.I.E.

MANAGING COMMITTEE.

Mr. T. Bainbrigge Fletcher, F.E.S., Mr. T. R. Bell, C.I.E., I.F.S. (Retd.)
Major R. Benson, D.S.O., Rev. E. Blatter, S.J., MR. B. C. Ellison, C.M.Z.S.
Lt.-Col. W. H. Evans, R.E., Major F. C. Fraser, I.M.S., Mr. A. E. Hefford.
Mr. J. E. B. Hotson, I.C.S., Prof. V. N. Hate, M.A., Mr. C. M. Inglis, F.Z.S., M.B.O.U.
Lt.-Col W. Glen Liston, C.I.E., I.M.S., Mr. F. Ludlow, I.E.S., M.B.O.U.
Mr. P. J. Mead, C.I.E., I.C.S., Mr. H. P. Macnaghten, M.A., M.L.C., MR J. C. Ridland.
Mr. P. M. D. Sanderson, Major C. H. Stockley, D.S.O., DR. D. A. Turkhud.
Mr. H. Whistler, F.Z.S., M.B.O.U., C.F.A.O.U.
Mr. R. A. Spence, the Honorary Secretary and Mr. H. F. Lodge, Honorary Treasurer being *ex-officio* members of the Committee.

SOCIETY'S REPRESENTATIVES IN ENGLAND.

W. S. Millard, Esq., F.Z.S., and E. C. Stuart Baker, Esq., M.B.O.U. C.F.A.O.U., F.Z.S.

ALTERATION IN RULES.

In accordance with the notice on the agenda Mr. R. A. Spence, the Honorary Secretary, moved that the following new rule be adopted and inserted between rules 2 and 3 :—

2 (*a*)

The Society shall consist of Life Members and Ordinary Members. The Committee are authorised to invite such persons as they may think fit to be Patron or Vice-Patrons of the Society.

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THE HONORARY SECRETARY'S REPORT FOR THE YEAR 1921.

With regard to the working of the Society during the past year the following may be of interest to members :—

MEMBERSHIP.

At the end of the year 1920 there were 102 Life Members on the roll of the Society and 1,744 Ordinary Members had paid their subscription for 1920. In 1921 financial stress compelled an increase in the annual subscription and in the entrance fee with a corresponding rise in the Life Membership donation. Old members were however allowed six months in which to become Life Members at the old rate and this privilege was availed of by no less than 49 members.

At the end of 1921 there were 151 Life Members on the books and 1,165 who had paid their subscription for 1921.

PRINCE OF WALES MUSEUM.

The past year has marked an important epoch in the history of the Society, namely the commencement of the Society's activities in its new role of maintaining and providing a Museum for the benefit not merely of its members but for the benefit of the public of Bombay. The scheme for the arrangement of the Society's display collections in the Prince of Wales Museum was prepared by Messrs. Ellison and Prater in March 1921 and at the time of His Royal Highness' arrival in India the Curators had arranged for his inspection and for that of the general public a very interesting display of the Fauna of the Indian Empire. Unfortunately the exhibit has had to be temporarily closed to the public until the necessary glass show cases have been obtained as without the protection afforded by air-tight cases the specimens would be attacked by living Natural History Specimens of a type better dead than alive.

Estimates have been prepared of the cost of show cases and also separate estimates of the cost of mounting specimens. The grant of Rs. 40,000 already made by the Bombay Government is about a lakh of rupees short of the amount required to carry out the Curators' Scheme in its entirety. It is evident from this that if the Public of Western India are to have a Museum worthy of the Prince of Wales and "Urbs Prima in Indis" a very generous response will have to be made to the appeal the Society is making for the provision of the necessary funds.

MAMMAL SURVEY.

The Mammal Survey has been continued during the past year and will be carried on throughout this year mainly in consequence of financial assistance received from the Central Government. This assistance has been given because of the value the Survey is to the Country and because the Society had provided in the past over a lakh of rupees for the carrying on of the Survey and it is in the interests of Government to help those who help Government to save money.

H. R. H. THE PRINCE OF WALES AND THE SOCIETY.

The past year will also be memorable on account of the connection of the Society with the visit of H. R. H. The Prince of Wales to India. It was with great pleasure that the Committee received intimation that their offer of the services of their Curator, Mr. Ellison, and some of the staff to supervise the skinning and mounting of trophies obtained by H. R. H. and the party in India had been accepted. It is with greater pleasure

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that the Committee record that the services Mr. Ellison and his party have been able to render have been appreciated and that H. R. H. has intimated his willingness to become a Life Member of this Society. It is hoped that the connection of H. R. H. with the Society may become even more closely marked.

APPRECIATION OF WORK OF THE STAFF.

The Committee take this opportunity of expressing their appreciation of the work done by the members of the Staff. The absence of the Honorary Secretary during part of the year and Mr. Ellison's deputation on the Prince's tour has thrown a good deal of work on to the shoulders of Mr. Prater. This extra burden he has cheerfully accepted and borne to the full satisfaction of all connected with the Society.

CONTRIBUTIONS TO THE MUSEUM.

MAMMALS.

1 Indian Elephant Skeleton (*E. maximus*), Kanara, M. S. Tuggerse.
1 Golden Cat (*F. temminckii*), Moulmein from Togon Valley, Tenasserim, G. Hundley.
1 Tenasserim Giant Squirrel (*R. melanopepla*), Moulmein from Togon Valley, Tenasserim, G. Hundley.
2 Taylor's Flying Squirrels (*P. taylori*), Moulmein from Togon Valley, Tenasserim, G. Hundley.
1 Leopard Cat (*F. bengalensis*), Moulmein from Togon Valley, Tenasserim, G. Hundley.
2 Skulls of Brow-Antlered Deer (*C. eldi*), Punjab, Major C. H. Stockley.
2 Skulls of Indian Gazelle (*G. bennetti*), Punjab, Major C. H. Stockley.
4 Skulls of Bears (*Ursus* sp.), Punjab, Major C. H. Stockley.
1 Sind Ibex (*C. hircus blythi*), Punjab, Major C. H. Stockley.
1 Tiger cub skull (*F. tigris*), Amraoti, R. A. Wilson.
1 Common Indian Mongoose (*M. m. mungo*), Amballa, A. E. Jones.
1 Albino Spotted Deer (*A. axis*), Mahomed Kharim Khan.
1 Indian Lion (*Felis leo*), from the Maharaja Kumar Sahib of Kotah.
1 Black Bear (*U. himalayanus*) (Rug), Lt.-Col. H. D. Peilo.
1 Black Bear (*U. himalayanus*), (Head mounted on shield), Lt.-Col. H. D. Peilo.
1 Large Burmese Civet Cat (*Viverra* sp.), Eindayaza, Tenasserim, Salim A. Ali.
1 Burmese Leopard Cat (*P. pardicolor*), Eindayaza, Tenasserim, Salim A. Ali.
1 Striped Burmese Squirrel (*T. maccellandi*), Eindayaza, Tenasserim, Salim A. Ali.
1 Golden-backed Squirrel (*C. cuneiceps*), Eindayaza, Tenasserim, Salim A. Ali.
2 Taylor's Flying Squirrels (*P. taylori*), Eindayaza, Tenasserim, Salim A. Ali
1 Langur (*Pithecus entellus*), Yellapur, Kanara, G. Amor.
3 Bats, Turjum Tea Estate, Darjeeling, Oscar Lindgren.
1 Yunan Flying Squirrel (*P. yunanensis*), Sikhim, F. M. Bailey.
5 Bats, Rustum, Right Bank of Dyala River, Mesopotamia, J. Fernandes.
1 Painted Bat (*K. picta*), Mandalay, Burma, C. C. Ghosh.

BIRDS.

1 The Eastern Red-breasted Flycatcher (*Siphia albicilla*), Ghazipur, U. P., E. H. N. Gill.

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1 Gull-billed Tern (*Sterna anglica*), Ghazipur, U. P., E. H. N. Gill.
1 Black Vulture (*Otogyps calvus*), Ghazipur, U. P., E. H. N. Gill.
1 Indian White-backed Vulture (*Pseudogyps bengalensis*), Ghazipur, U. P., E. H. N. Gill.
1 Spoon-bill (*Platalea leucorodia*), Jodhpur, Rajputana, Miss P. Hawksley.
2 Quails (*Microperdix* sp.), Manipur, Assam, Mr. Clarke.
2 Chinese Francolin (*F. chinensis*), Mr. Clarke.
1 Western Blue-rock Thrush (*M. S. pandoo*), Khandalla, A. Fitzgerald.
1 Malabar Wood Shrike (*T. pondicerianus*), B. E. C. Beadnell.
1 Peregrin Falcon (*F. peregrinus*), Bakloh, Punjab, Capt. Chas. Bilderbade.
2 Western Blossom-headed Paroquets (*P. cyanocephalus*), Yellapur, Kanara, G. Amor.
1 Palm Swift (*T. batassiensis*), Salem, D. F. Stileman.
1 Indian Grebe (*P. albipennis*), Salem, D. F. Stileman.
1 Large Pied Wagtail (*M. madraspatensis*), Salem, D. F. Stileman.
1 Indian Tree pie (*D. rufa*), Salem, D. F. Stileman.
1 Indian Bee-eater (*M. viridis*), Salem, D. F. Stileman.
1 Common Indian Hawk Cuckoo (*H. varius*), Salem, D. F. Stileman.
1 Common Indian Roller (*C. indica*), Salem, D. F. Stileman.
1 Black Drongo (*D. ater*), Salem, D. F. Stileman.
A large collection of Birds, Bengal, C. M. Inglis.*
47 Birds, Munchar, Sind, Capt. C. E. Benson.
49 Birds, Yellapur, Kanara, Capt. C. E. Benson.
2 Birds, Burma, F. Kingdon Ward.
10 Birds, including 3 Tragopans (*T. temminckii*) and one Koklass pheasant (*P. macrolopha*). Nepal, B. C. Ellison.

Birds Eggs.

1 Bird's egg, Aurangabad, Deccan, Major C. C. Hicks.
4 Eggs (*P. torquatus*), Larkana, Sind, George Amore.
3 Eggs (*Gallus soneratti*), S. India, A. P. Kinloch.

Birds Nests.

1 Nest of Nilgiri Babbler (*Alcippe* sp.), Silver Cascade, S. India, Chas. McCann.
2 Nests of Nilgiri Babbler (*Niltava* sp.), Silver Cascade, S. India, Chas. McCann.

Reptiles.

Snakes.

1 Fasciolated Rat Snake (*Z. fasciolatus*), Thana, Bombay Presidency, Purchased.
1 Anamallay Viper (*L. anamallensis*), Silver Cascade, S. India, Chas. McCann.
1 Common Wolf Snake (*L. aulicus*),
2 Common Keelbacks (*T. stolatus*),
1 Green Keelback (*M. plumbicolor*),
1 Russell's Viper (*V. russelli*),
} F. Poole.
1 Helen's Snake (*C. helena*), S. India, A. P. Kinloch.
3 Blind Snakes (*S. brevis*), S. India, A. P. Kinloch.
4 (*Ablabes calamaria*), Kangra District, Punjab, H. Whistler.
2 Common Keelbacks (*T. stolatus*), Kangra District, Punjab, H. Whistler.

* This is the largest collection presented to the Society since 1914. A list will be published in a further number of the Journal.

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2 Himalayan Vipers (*A. himalayanus*), Kangra District, Punjab, H. Whistler.
2 Young Cobras (*N. tripudians*), Karachi, F. Wall.
1 (*U. grandis*), F. Wall.
1 (*D. pulverulentus*), Matugama, Ceylon, F. Wall.
1 Tree Snake (*Dipsas ceylonensis*), Matugama, Ceylon. F. Wall.
4 (*Acontia burtoni*), Matugama, Ceylon, F. Wall.
1 Common Sand Boa (*E. conicus*), Ahmedabad, F. Wall.
3 Saw-scaled Vipers (*E. carinata*), Karachi, A. Flynn.
1 Common Wolf Snake (*L. aulicus*), Igatpuri, District Surgeon.
1 Common Sand Boa (*E. conicus*), Igatpuri, District Surgeon.
1 (*Lioselasma spiralis* ♀), Henjam, P. Gulf, Capt. Mody.
1 (*Lioselasma cyanocinctus*), Henjam, P. Gulf, Capt. Mody.
6 Snakes, Nagrispur, Darjeeling, Oscar Lindgren.
1 Rat Snake (*Z. mucosus*), Yellapur, Kanara, G. Amore.
1 Common Green Whip Snake (*D. mycterizans*), Yellapur, Kanara, G. Amore
3 Large-scaled Vipers (*L. macrolepis*), Silver Cascade, S. I., Chas. McCann.
1 Common Checkered Snake (*T. tassellatus*), Nahrumar, Mesopotamia, Capt. R. N. Seval.

Lizards.

3 *Eumeces schneideri*,
3 *Eumeces scuttatus*,
2 *Eublepharis macularius*,
3 *Agama isolepis*,
1 *Agama rubrogularis*,
2 *Agama nupta*,
1 *Agama caucasica*,
1 *A. lirata*,
4 *Lygosoma* sp.,
} Capt. C. M. Ingoldby.
1 Gecko, Karachi, F. Wall, I.M.S.
3 *Draco* sp., Yellapur Kanara, G. Amore.
1 Gecko, Yellapur, Kanara, G. Amore.

Fish.

2 Fish, S. India, A. P. Kinloch.
1 *Octopus* sp., Mahim Beach, A. F. Ferguson.
1 Fish, Hassimara Duars, H. V. O'Donel.

Insects.

1 Glow Worm, Mysore, Van Ingen.
1 Giant Centipede, S. India, D. G. Cameron.
1 *Vespa cincta*, S. India, A. P. Kinloch.
1 Box of Dragonflies, Bangkok, Siam, E. W. Trotter.
6 Moths (*Agrotis flammatra*), Lt.-Col. J. Patterson.
Minor contributions from J. Fernandes, Mesopotamia, A. Fitzgerald, Khandala, E. M. Van Ingen, Mysore, Capt. S. Jervis.

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JOURNAL

OF THE

Bombay Natural History Society.

DEC. 1922. VOL. XXVIII. No. 4.

THE GAME BIRDS OF INDIA, BURMA AND CEYLON.

BY

E. C. STUART BAKER, F.L.S., F.Z.S., M.B.O.U., C.F.A.O.U.

PART XXXIII.

(Continued from page 575 of this Volume).

(With a plate).

GENUS—*AMMOPERDIX.*

The genus *Ammoperdix* contains two species of small partridges which are found from Egypt to South Arabia, *A. heyi* and its races, and through Persia, Mesopotamia, Afghanistan and Baluchistan to N. W. India, *A. griseogularis* and its sub-species.

The tail is short, measuring about half the length of the wing, and consists of 12 tail feathers; the wing is rounded, the third or fourth primary the longest, and the first, second, fifth and sixth a little shorter and graduated; the legs are strong and the tarsus fairly long. There are no spurs, but a few males show a small knob or incipient spur; the bill has a very distinct cere, rather brighter in colour than the rest of the bill.

The Indian bird *A. griseogularis griseogularis* is replaced in Arabistan and ? Mesopotamia by an allied form *A. griseogularis termeulin*, Zarudny.

AMMOPERDIX GRISEOGULARIS GRISEOGULARIS.

The See-see Partridge.

Perdix griseogularis, Brandt, Bull. Acad. St. Pet., I., p. 3655, (1843), (India).

Perdix bonhami, Frazer, P.Z.S., 1843, p. 70, (Teheran); Des Murs, Icon. Orn., pl. 29, (1849).

Caccabis bonhami, Gray, A.M.N.H., XI, p. 372, (1843).

Ammoperdix bonhami, Gould, B. of A. pl. I, (1851); Adams, P.Z.S., 1858, p. 503, (N. Punjab); Jerdon, B. of I., III, p. 567, (1863);

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Hume, S.F., I, p.226, (1873), (Sind and Mekran); id, Nests and Eggs, p. 540, (1873); Butler S.F., III, p. 209, (1875), (Suliman Hills); Dresser, Ibis, 1876, p. 323; Butler, S.F., IV, p. 41, (1876), (Guzerat); Blanf., E. Persia, II, p. 274, (1876), (Shiraz); Butler, Cat. B. of Sind, p. 54, (1879); Hume and Marsh., Game-B., II., p. 45, (1879); Barnes, S.F., IX, pp. 219, 458, (1880), (Chaman); Swinhoe, Ibis, 1882, p. 119, (S. Afghanistan); Sharpe, ibid, 1886, p. 498, (Bushire); Pleske, Mem. Acad. St. Pet., 7, XXXVI, 3, p. 47, (1888), (Bokhara); St. John, Ibis, 1889, p. 175, (S. Afghanistan); Oates, Hume's Nest and Eggs, III., p. 433, (1890); Ogilvie-Grant, Cat. B.M., XXII, p. 123, (1893); id, Hand l. Game-B., I., p. 99, (1895); Blanf. and Oates, Avifauna, B.I., IV, p. 133, (1898); Oates, Man. Game-B., I, p. 185, (1898); Rattray, J.B.N.H.S., XII, p. 345, (1900), (Thull); Marshall, ibid XV, p. 353, (1904), (Quetta); Cumming, ibid, XVI, p. 692, (1905), (Seistan); Whitehead, Ibis, 1909, p. 269, (Kohat and Kurram); id, J.B.N.H.S., XX, p. 969, (1911), (Kurram); Meinertzhagen, J.B.N.H.S., XXIII, p. 363, (1914), (Quetta); Whistler, Ibis, 1816, p. 99, (Jhelum); Thornhill, J.B.N.H.S., XXV, p. 486; Cumming, J.B.N.H.S., XXVI, p. 294, (1918), (Fao).

Ammoperdix griseogularis, Filippi, Viag. St. Petersb., I, p. 351, (1865); Meinertzhagen, Ibis. 1920, p. 187, (Quetta).

Perdix cinereogularis, Cabanis, J.F.O. 1873, p. 458.

Ammoperdix griseogularis griseogularis, Hartert, Nov. Zool. XXIV. p. 282, (1917).

Vernacular Names—*Sisi* (Punjab, Sind); Tihu, (Persian).

Description—Adult Male.—Forehead, supercilium and a narrow streak under the eye black; lores and behind the eye white, turning to rufous behind the ear-coverts; crown and nape ashy grey, turning to vinous red on the centre of the hind neck which is obsoletely barred with grey; back and interscapulars vinous red, profusely marked with wavy bars of grey, the red varying much in depth and extent; lower back, rump, upper tail coverts and central tail-feathers vinous buff, very finely vermiculated with grey and with tiny central arrow-head markings of black; outer tail-feathers chestnut, with paler, faintly vermiculated tips; sides of neck grey with broad white triangular spots; chin fulvous white changing to pure ashy grey on throat, sides of head and foreneck; breast vinous buff, becoming a more distinct vinous on the lower breast and flanks and changing to a more yellowish tint on abdomen and under tail-coverts; the feathers of the flanks and sides of the belly have internal edges of black, and external broad margins of chestnut paling to pearly white; wings like the back, the primaries and outer secondaries light brown, all but the first barred with pale buff on the outer webs.

Colours of Soft Parts.—"Legs and feet pale dingy wax yellow, in some greenish, in some dusky yellow; claws pale brown; the irides vary a good deal; they are generally either bright yellow, orange, or

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orange brown; but in some specimens they were dull red, and in some a bright brown; the bill is generally orange, somewhat dusky on the culmen; in some, however, it is a brownish orange-red, and in the females, especially, often brown above and orange below, or even yellowish brown or ripe olive; the cere is generally a hoary orange red, sometimes only brown." (Hume).

Measurements.—Length 250 to 270 mm.; wing 123 to 139 mm.; tail 60 to 68 mm.; tarsus 32 to 34 mm.; culmen about 11 to 12·5 mm. "Weight, 7 to 8 ozs." (Hume).

Females have the head like the back, which is similar to that of the male but almost without the red tinge; the wing-coverts are less finely marked and the inner webs of the inner secondaries are much marked with brown; the lower parts are coloured like the upper but paler, the throat and belly being albescent and the under tail-coverts buff.

Colours of Soft Parts.—Similar to those of the male with the exceptions noted above.

Measurements.—The females average a little smaller than the males; wings 123 to 133 mm.; tail 59 to 62 mm.; tarsus 31 to 33 mm.; culmen 11 to 12 mm.

Distribution.—"Greater part of Persia, West to Berijik and Kum-Kale on the Euphrates, North to Transcaspia and Bokhara, Afghanistan, Baluchistan to Sind and the Indus and across the Indus Valley to the Khariar Hills and Salt Range in the Punjab." (Hartert).

Nidification.—The See-see breeds during April, May and June at all heights from the lowest foothills and broken ground adjoining the actual plains up to some 6,000 or 7,000 feet. Whitehead found them breeding in Chitral, in the Kurram Valley and Kohat up to the latter height, and in Afghanistan, eggs have been taken at 7,000 feet. The nest consists merely of a scratching in the ground, lined only with such scraps of grass leaves as the winds may provide or, perhaps, a few fallen feathers of the parent birds. Occasionally rather more attempt is made at a nest, a few leaves and pieces of grass being collected by the bird and placed in the nest hollow, but such attempts are rare and, even then, the results but meagre.

The site selected is often on the most bare and stony ground, with no more shelter than is provided by a boulder larger than the rest, or a tuft of the coarse yellow grass which struggles here and there for existence. Sometimes it is down in a ravine, well protected by an overhanging rock or a bush or, at other times, in an equally well protected crevice on the side of a steep hill. One nest has been found placed in the angle of the parapet on the flat roof of a temporarily uninhabited house.

The eggs number anything from 5 to 14, but the normal clutch probably varies from 6 to 9. In colour they range from a faint pearly

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white to a decided cream or pale café-au-lait; most eggs are a pale cream with a distinctly grey tint about them. As a rule they are rather dull coloured eggs even when quite fresh, and they are never very bright in tint or highly glossed. The texture is close and fine, the surface often much pitted with tiny pores, but at other times quite devoid of these.

In shape they vary from sub-pyriform to long ovals, but 9 eggs out of 10 are well pointed at the smaller end.

Fifty eggs average 35·5 ×26·2 mm., whilst the extremes are, maxima 38·7×26·8 mm. and 37·3×28·3 mm.; minima 33·0 × 26·0 mm. and 34·1×24·7 mm.

The hen is said not to be a very close sitter unless the eggs are far advanced in incubation when she will sit on until the intruder almost touches her. When the eggs are fresh she sneaks off quietly whilst the enemy is still far away. The cock-bird is said to wander about close to the vicinity of the nest and to assist in the care of the chicks as soon as they are hatched.

General Habits.—The See-see, even more than the Chukor is a bird of barren hills, bare broken ground and wastes of boulders, stones and sun-beaten soil. In forest they are never found and in bush jungle but seldom, on the other hand in the early mornings and late afternoons they frequent grass lands and crops for the purpose of feeding. In the middle of the day, however, they leave them for the shelter of the ravines and broken ground, generally seeking the protection from the sun afforded by the larger boulders and rocks, or by some deep crack, but occasionally lying up in a clump of bushes or dead grass. They seem to be curiously addicted to deserted stone buildings and ruins. Repeatedly they have been reported as common about ruins in Persia and Afghanistan, and Hume also refers to this trait. He writes:—

> "They are generally seen running on the bare rocks or pecking about the droppings of cattle on the mountain paths; but at Tobar—some 2,000 feet high, the rainy season residence of the miners, who, during the rest of the year, reside in the Khewra Gorge (some 700 feet above the sea) and work the neighbouring Salt Mines,—I saw several pairs running about the flat roofs of the houses. The males may often be seen perched on some rocky point, and the female, in the spring, though less commonly seen in exposed positions, will always be found close to her mate. They run very rapidly and fly smartly, always, if possible, down hill."

Hume did not consider them much of a game-bird, though he records shooting eleven and a half brace in a day. At the same time a morning with the See-see may give much pleasure and enjoyment and is a welcome change from an office chair and everlasting report-writing.

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Col. H. L. Haughton sends me the following account of a morning's shoot which is quite typical of the See-see and the sport to be obtained with this bird.

"I once knew a Colonel who declared that he had shot every feather off a See-see and then it had flown away naked !!!

"This may be somewhat of an exaggeration of the See-see's powers of resistance to shot, but it serves to bear out my own limited experience that this little partridge is not an easy bird to hit, and that even when hit the bird is by no means always in the bag.

"As regards the first proposition it may be said that the colouring of the See-see blends so well with the hues of the terrain in which he is usually to be found that he is not easy to see either dead or alive. Again, though he moves at a good pace it is not his speed but the fact that as often as not he is on the curve, dropping or fast disappearing round a corner that makes him difficult to hit against a background into which he merges so well.

" Supposing, however, he is hit. If he falls dead and you see him fall, mark the spot and pick him at once, well and good. If on the other hand, he has a spark of life left in him he well hide away in a manner which will cause you to lose many precious minutes looking for him, or you may lose him altogether.

"A hole in a cliff, a crevice under a rock, any nook or cranny will serve him as a refuge, and as the ground he haunts is full of such harbours of refuge it is wonderful how quickly he will disappear. To make matters worse you often cannot actually see him fall, for when you put him up he instinctively makes for some nullah or water course the edge of which he reaches just as you fire : down he goes over the edge and sometimes you are in doubt as to whether you have hit him at all.

"Almost any low foothills or network of sandy, stony nullahs in the North West Frontier Province or the Northern Punjab hold See-see, and as typical examples one might take the Margalla Range which crosses the Rawalpindi-Peshawar Road, or the water-worn nullahs which, running from the Frontier hills, intersect the Peshawar Plain.

A day after See-see probably means getting other game as well, such as grey partridge, a hare or two, possibly some sand grouse and in some places Chukor. In this respect the Phandu nullah near Peshawar used to be in the old days a most attractive spot, and an entry in my game-book recalls a very pleasant and profitable morning spent there. My first impression of that day is scarcely a pleasant one for it consists of a recollection of a start in the dark and a drive in the bitter cold of a Peshawar morning before dawn. This early start was necessary in order to reach the ground in time to catch any possible sand grouse that might come to water at the shallow stream which in those days—though I believe no longer—meandered down the Phandu nullah from the Bara River. Ears tingled in the cold which brought

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the water to one's eyes, and thick boots and gloves scarce served to keep a vestige of warmth in feet and fingers. And yet, looking back on it all, there was a wonderful fascination in skirting round the sleeping city whence came as yet no sound but the barking of a dog, the tinkle of bells from some shaggy camel drowsily shaking his head in the Kabul Sarai, the crowing of a cock or the voice of the Muezzin, each in his own way heralding the coming dawn, sharp and clear in the frosty air. Dawn breaks shortly before the nullah is reached and on arrival some conveniently placed straw, sticks, etc., are set alight and serve to make a cheerful blaze at which hands may be warmed for a moment before beginning the business of the day.

"The shikari had made arrangements for a couple of lads to meet us, and when a start was made the *modus operandi* was as follows :—

"The nullah at this point was too broad for both sides to be worked by one gun, so the shikari and I made our way along the bottom of the nullah, following the stream, whilst the two lads were to form line with us along the top of the cliffs which flank the nullah on either side, one keeping along the edge of the cliffs and throwing down stones into such cover as there might be, and the other keeping out some distance in the plain to round up any birds which might be out feeding on the plain or in the scattered patches of cultivation which occurred here and there. We had scarcely gone a hundred yeards when out came a See-see from a deep waterworn fissure in the cliffs. Directly this bird takes wing, one knows it is a See-see for his fast beating wings make a sound which to me always seems to be rather a metallic "tinkle" than the "whirr" of the large partridges. I can see that bird now as he shot straight down the deep cleft towards me for a second and then, as my gun went up he swerved abrubtly round the corner and up the main nullah, with the result that I missed him badly and plastered the cliff with shot yards behind him.

"And so it went on up the nullah, several See-see being brought down and several missed. Occasionally a bird would cross the nullah from the cliffs on one side to those opposite, but generally it was a case of a bird skimming away following the line of the cliffs and slipping round a corner, or of birds driven in from the edge of the plain on top. These latter, put up by one of the boys, would drop like stones into the nullah over the edge of the cliffs where they thought they were safe. The discovery that they had as it were jumped out of the frying pan into the fire must have been a rude shock to them, but they did not lose their nerve for long, and would jink, turn and swing away the moment thay saw one, often offering most puzzling shots in their sudden changes of direction.

"A couple of blue rock pigeon were added to the bag out of a good number seen, and some duck, disturbed higher up, and coming straight down the stream, gave me a beautiful shot which resulted in the death of their leader, a fine drake gadwal. A patch of scrub gave me

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a chance of right and left at ordinary grey partridge, of which I did not fully avail myself, missing with my first, but killing a bird with my second barrel.

"The last shot, just before halting for a late breakfast, was in some ways a most satisfactory one. I remember I had just been trying to beat out a couple of See-see which had disappeared round a corner after running in front of me for a long way in the most impertinent manner. Before disappearing one had hopped up on to a mass of fallen earth at the foot of the cliff, his little neck stretched up to look back at me, in an attitude which reminded me at once of a cheeky boy "cocking a snook" at a policeman round the corner before bolting, his whole person exuding the essence of impertinence, and that was the last I ever saw of him. Where he went to Goodness only knows. Just as we were giving it up a soft note caused me to look up in time to see two Imperial Sandgrouse coming straight up the nullah. They were moving at a great pace and neither showed a sign of being touched as I fired; but whilst following them ruefully with my eyes, I suddenly saw one bird crumple up and fall stone dead about 150 yards behind me.

"One Gadwal, one Sandgrouse, one grey partridge, some Blue Rock and the nine See-see, which I had got by about 11 o'clock were the outward signs of a very pleasant morning in the Phandu nullah, a morning typical of the shooting obtainable round Peshawar in those days."

Opinions differ greatly as to the qualifications of the See-see for the table. Hume and some others describe them as dry, insipid and poor eating, others modify this and say they are "fair to middling", whilst yet others consider them to be amongst the best of our Indian Partridges and Pheasants.

They appear to be almost entirely vegetarian in their diet, subsisting largely on grass seeds, but doubtless they eat a few insects from time to time and undoubtedly eat ants freely, and of course termites. The young, when first hatched, are probably fed, as are all other partridges, principally on insects, and amongst insects for the main part on ants.

Their call is a loud double whistle, sounding like See-see or So-see and gives the birds their trivial name, but they have a low soft whistle which they utter when feeding in company or as a call to their young.

Apparently the family coveys in which the See-see keeps during the summer and autumn often break up in the early winter when many birds are again seen singly or in pairs though other parties keep together until the end of March or early April when the business of preparing for the next brood commences in earnest.

The Plate is a good one and represents our typical Indian bird. The third bird is a male in the attitude adopted when displaying to the female and, extraordinary as it seems, is quite true to life.

(*To be continued.*)

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HAND-LIST OF THE "BIRDS OF INDIA."

BY

E. C. STUART BAKER, F.L.S., F.Z.S., M.B.O.U., C.F.A.O.U.

PART VII.

(*Continued from page* 594 *of this volume.*)

Order COLUMBÆ.

Family COLUMBIDÆ.

Sub-family *Treroninæ.*

1695. (1271) **Crocopus phœnicopterus phœnicopterus.** *The Bengal Green Pigeon.*

Columba phœnicoptera *Lath., Ind., Orn., ii., p.* 597 (1790), (*in insula Eimeo*).

Central and N. E. India to Assam N. of Brahmaputra.

1696. (1271) **Crocopus phœnicopterus viridifrons.** *The Burmese Green Pigeon.*

Treron viridifrons *Blyth, J. A. S. B., xiv., pt.* 2, *p.* 849 (1845), (*Tennasserim*).

Assam S. of Brahmaputra, Burma S. to Moulmein, E. to Cochin.

1697. (1272) **Crocopus phœnicopterus chlorogaster.** *The Southern Green Pigeon.*

Vinago chlorogaster *Blyth, J. A. S. B., xii, pt. i., p.* 167 (1843), (*Indian Pen.*)

India S. of the range of 1696, Ceylon, N. W. to sub-Himalayas.

*1698. (1275) **Treron pompadora pompadora.** *The Pompadour Green Pigeon.*

Columba pompadora *Gmel., S. N., i., p.* 775 (1789), (*Ceylon*).

Ceylon only.

1699. (1273) **Treron pompadora phayrei.** *The Ashy-headed Green Pigeon.*

Osmotreron phayrei *Blyth, J. A. S. B., xxxi., p.* 344 (1862), (*Tounghoo*).

E. Bengal, Assam, Burma, S. to Tavoy and E. to Cochin China.

* The generic name *Osmotreron* Bonaparte, 1854, is antedated by *Dendrophasa* Gloger, 1842, and cannot therefore be used but *Osmotreron* and *Treron* (Vieill 1816) are not separable so that the latter name will be retained.

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1700. (1274) **Treron pompadora affinis.** *The Grey-fronted Green Pigeon.*

Vinago affinis *Jerd., Madr. J. L. S., xii., p.* 13 (1840), (*Malabar Coast*).

West Coast of India from Kanara to Cape Comorin.

1701. (1276) **Treron pompadora chloroptera.** *The Andamanese Green Pigeon.*

Treron chloroptera *Blyth, J. A. S. B., xiv., p.* 852 (1845), (*Nicobars*).

Andamans and Nicobar Islands.

*1702. (1277) **Treron fulvicollis fulvicollis.** *The Cinnamon-headed Green Pigeon.*

Columba fulvicollis *Wagler, Syst. Av. Columba* (1827), (*Java*).

S. Burma and Siam, Malay Pen., Sumatra (? Celebes, Philippines, etc.).

1703. (1278) **Treron bisincta bisincta.** *The Lesser Orange-breasted Green Pigeon.*

Vinago bisincta *Jerd., Madr. J. L. S., xii., p.* 13 (1840), (*Madras*).

Bombay S. from Kanara, Madras S. of lat. 14, and Ceylon.

1704. (1278) **Treron bisincta domvillii.** *The Larger Orange-breasted Green Pigeon.*

Osmotreron domvillii *Swinh., Ibis,* 1870, *p.* 354 (*Hainan*).

Orissa, Bengal, Assam, Burma, Cochin China, Siam and Malay Pen.

1705. (1279) **Treron vernans vernans.** *The Pink-necked Green Pigeon.*

Columba vernans *Linn., Mant., p.* 526 (1771), (*Philippines*).

Peninsular Siam and Burma to Sumatra, Borneo and Philippines.

1706. (1281) **Treron curvirostra nipalensis.** *The Thick-billed Green Pigeon.*

Toria nipalensis *Hodgs., As. Res., xix., p.* 164 (1836), (*Nipal*).

Himalayas, Nepal to E. Assam, Burma, Shan States, Yunnan, Cochin China, Siam.

* Type locality changed to Sumatra. Robinson, Siam N. H. J., v., p. 30, 1921.

† I cannot separate Robinson's and Smith's *T. b. prætermissa* from Siam (Siam J. N. H., v., p. 29, 1921).

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1707. (1280) **Butreron capellii.** *The Large Thick-billed Green Pigeon.*

Columba capellii *Temm., Pl. Col., pl.* 143 (1823), (*Java*).

Mergui, South to Java.

1708. (1282) **Sphenocercus apicaudus.** *The Pin-tailed Green Pigeon.*

Treron apicauda *Blyth, J. A. S. B., xiv., p.* 854 (1845), (*S. E. Himalayas*).

Himalayas, Kumaon to E. Assam, Hills of Burma and Siam to Malay Pen.

1709. (1283) **Sphenocercus sphenurus.** *The Wedge-tailed Green Pigeon.*

Vinago sphenura, *Vigors, P. Z. S.*, 1831, *p.* 173 (*Darjiling*).

Kashmir to E. Assam, Chin Hills, Shan States to Tennasserim.

Sub-family *Duculinæ.*

1710. (126) **Ducula badia insignis.** *Hodgson's Imperial Pigeon.*

Ducula insignis *Hody., As. Res., xix., p.* 162 (1836), (*Nipal*).

Nepal to E. Assam, N. of Brahmaputra, Naga Hills.

1711. (1287) **Ducula badia griseicapilla.** *The Grey-headed Imperial Pigeon.*

Ducula griseicapilla *Wald., A. M. N. H., xvi.*, p. 228 (1875), *Karen Hills.*

Assam, S. of Brahmaputra, Burma, Shan States and Siam.

1712. (1288) **Ducula badia cuprea.** *Jerdon's Imperial Pigeon.*

Columba cuprea *Jerd., Madr. J. L. S., xii., p.* 12 (1840), (*Malabar*).

S. W. India from Kanara to Cape Comorin Ceylon.

1713. (1284) **Muscadivores ænea ænea.** *The Green Imperial Pigeon.*

Columba ænea *Linn., S. N.* 1, *p.* 283 (1766), (*Moluccas in errore*), (*Flores*).

Pen Burma and Siam to Flores.

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1714. (1284) **Muscadivores ænea sylvatica.** *The Northern Green Imperial Pigeon.*

Columba sylvatica *Tickell, J. A. S. B. ii., p.* 581 (1833), (*Borabhum and Dhabbhum*).

India East of long. 80°, Burma, Shan States, Siam, Andamans.

1715. (1284) **Muscadivores ænea pusilla.** *The Ceylon Green Imperial Pigeon.*

Carpophaga pusilla *Blyth, J. A. S. B., xviii., p.* 816 (1849), (*Ceylon*).

Ceylon and S. W. India to Kanara.

1716. (1285) **Muscadivores ænea insularis.** *The Nicobar Green Imperial Pigeon.*

Carpophaga insularis *Blyth, J. A. S. B., xxvii., p.* 270 (1858), (*Nicobars*).

Nicobars only.

1717. (1289) **Myristicivores bicolor.** *The Pied Imperial Pigeon.*

Columba bicolor *Scop., Del. Flor. et Faun. Insubr., ii., p.* 94 (1786), (*New Guinea*).

Andamans, Nicobars through Malay Arch. to Australia. West Malay Pen.

Sub-family *Calœnadinæ.*

1718. (2190) **Calœnas nicobarica.** *The Nicobar Pigeon.*

Columba nicobarica *Linn., S. N., p.* 164 (1758), (*Nicobars*).

Cocos, Andamans and Nicobars. Straggler to Malay Pen.

Sub-family *Phabinæ.*

1719. (1291) **Chalcophaps indica.** *The Emerald Dove.*

Columba indica *Linn., S. N., ed. x., p.* 164 (1758). (*in India orientali*).

Ceylon, the greater part of India, Burma, Malaya, etc.

Sub-family *Columbinæ.*

1720. (1292) **Columba livia intermedia.** *The Indian Blue Rock-Pigeon.*

Columba intermedia *Strick., A. M. N. H.,* 1844, *p.* 39 (*Inäia*).

Ceylon, India, Burma, Siam, etc.

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1721. (1293) **Columba livia neglecta.** *Hume's Blue Rock-Pigeon.*

Columba neglecta *Hume, Lahore to Yar., p.* 272 (1873), (*Ladak*).

Turkestan, East Persia, Baluchistan, Afghanistan, Ladak and N. Kashmir.

1722. (1294) **Columba rupestris turkestanica.** *The Indian Blue Hill-Pigeon.*

C. r. turkestanica *Buturlin, Orn. Monatsb., p.* 45 (1908), (*Altai*).

Altai, Turkestan, Tibet and Northern Himalayas.

1723. (1295) **Columba œnas eversmanni.** *The Eastern Stock-Pigeon.*

Columba eversmanni *Bonaparte, Compt. Rend., xliii p.* 838 (1856), (*Central Asia*).

Turkestan to N. W. India in winter.

1724. (1296) **Columba leuconota leuconota.** *The White-bellied Pigeon, or Snow-Pigeon.*

Columba leuconota *Vigors, P. Z. S. I., p.* 23 (1831) (*Himalayas.*)

Himalayas from Chitral to Sikkim.

1725. **Columba leuconota gradaria.** *The Tibetan Snow-Pigeon.*

Hartert, Nov. Zool., 1916, *p.* 85 (*Szetschwan*).
From N. E. Sikkim to N. W. China.

1726. (1297) **Dendrotreron hodgsoni.** *The Speckled Wood-Pigeon.*

Columba hodgsoni *Vigors, P. Z. S.*, 1832, *p.* 16 (*Nepal*).

Kashmir to E. Assam, N. Burma, Shan States, Yunnan and Siam.

1727. (1298) **Palumbus palumbus casiotis.** *The Eastern Wood-Pigeon or Ring-Dove.*

Palumbus casiotis *Bonap., Consp. Gen. Av., u., p.* 42 (1854), (*Himalayas*).

Turkestan to N. W. India and Sind.

1728. (1299) **Alsocomus elphinstonii.** *The Nilgiri Wood-Pigeon.*

Ptilinopus elphinstonii *Sykes, P. Z. S.*, 1832, *p.* 149 (*Nilgiris*).

Hill-tracts of S. W. India, Bombay to Cape Comorin.

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1729. (1300) **Alsocomus torringtonii.** *The Ceylon Wood-Pigeon.*

Palumbus torringtonii *Bonap. Consp. Gen. Av., u. p.* 42 (1854), (*Ceylon*).

Ceylon only.

1730. (1301) **Alsocomus pulchricollis.** *The Ashy Wood-Pigeon.*

Columba pulchricollis *Hodgs. in Gray's Zool Misc., p.* 85 (1844), (*Nepal*).

Eastern Himalayas from Nepal to Shan States.

1731. (1302) **Alsocomus puniceus.** *The Purple Wood-Pigeon.*

Alsocomus puniceus *Tick., Blyth, J. A. S. B., xi., p.* 461 (1842), (*Chyebassa*).

N. E. India to Burma, Shan States, Yunnan, Cochin China, Siam to Malay Pen.

1732. (1303) **Alsocomus palumboides.** *The Andamanese Wood-Pigeon.*

Carpophaga palumboides *Hume, S. F. i., p.* 302 (1873), (*Andamans*).

Andaman and Nicobar Islands.

*1733. (1306) **Streptopelia turtur turtur.** *The Turtle-Dove.*

Columba turtur *Linn., S. N., i., p.* 164 (1758), (*England, Willoughby*).

? One specimen from Quetta.

1734. (1306) **Streptopelia turtur arenicola.** *The Persian Turtle-Dove.*

Turtur turtur arenicola *Hartert, Nov. Zool.,* 1894, *p.* 42 (*Persia*).

Straggler into N. W. India.

1735. (1304) **Streptopelia orientalis orientalis.** *The Rufous Turtle-Dove.*

Columba orientalis *Lath., Ind. Orn., ii., p.* 606 (1790), (*China*).

E. Siberia, China, Japan to Tibet, Nepal and Sikkim.

1736. (1305) **Streptopelia orientalis meena.** *The Indian Rufous Turtle-Dove.*

Columba meena *Sykes, P. Z. S.,* 1832, *p.* 149 (*Deccan*).

Breeding Himalayas and Central Asia. Winter almost all India. Ceylon.

* Hartert has dealt fully with this genus both in his Vog. Pal. *xi.*, p. 1483 (1920) and in Nov. Zool.

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1737. (1306) **Streptopelia orientalis agricola.** *The Indian Turtle-Dove.*

Columba agricola *Tick., J. A. S. B., u., p.* 581 (1833), (*Borabhum*).

Practically all India, Assam, Burma to Tennasserim.

1738. (1307) **Streptopelia chinensis suratensis.** *The Indian Spotted Dove.*

Columba suratensis *Gmel., S. N., i., p.* 778 (1789) (*Surat*).

All India to E. Assam, N. of Brahmaputra.

1739. **Streptopelia chinensis ceylonensis.** *The Ceylon Spotted Dove.*

Turtur ceylonensis *Reichenbach, Vol. Nat. Tauben., Fig.* 3373 (1851), (*Ceylon*).

Ceylon and South Travancore.

1740. (1308) **Streptopelia chinensis tigrina.** *The Burmese Spotted Dove.*

Columba tigrina *Temm., Les Pigeons, p.* 94 (1810) (*Java*).

Assam S. of Brahmaputra, Burma to Malay Pen. and Islands.

1741. (1309) **Streptopelia senegalensis cambayensis.** *The Little Brown Dove.*

Columba cambayensis *Gmel., S. N., i., p.* 779, (1789), (*Cambaya*).

India W. of the Hugli, Ganges and Kusi Rivers.

1742. **Streptopelia senegalensis ermanni.** *The Persian Little Brown Dove.*

Turtur ermanni *Bonap., Compt. Rend., p.* 942 (1856), (*Bochara*).

Turkestan, Persia, Afghanistan, Baluchistan (Quetta).

1743. (1310) **Streptopelia decaocto decaocto.** *The Indian Ring-Dove.*

Columba risoria decaocto *Frivalszky, A. M. Tarsasag Evk., p.* 183 (1838), (*Turkei*).

Western Europe to India and Ceylon, China to Japan.

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1744. (1310) **Streptopelia decaocto xanthocycla.** *The Burmese Ring-Dove.*

Turtur decaocto xanthocycla *Newman, Av. Mag., iv., p.* 324 (1906), (*Burma*).

Burma, Siam, Shan States, Cochin China, Yunnan.

1745. (1311) **Oenopopelia tranquebarica tranquebarica.** *The Indian Red Turtle-Dove.*

Columba tranquebarica *Herm., Observ. Zool., p.* 200 (1804), (*Tranquebarica*).

India from N. W. to Ceylon, E. to Behar and Bengal.

1746. (1311) **Oenopopelia tranquebarica murmensis.** *The Sikkim Red Turtle-Dove.*

Hartert, Vog. Pal. xii., p. 1499 (1920), (*Nepal*).

Nepal and Sikkim, East to Assam, N. of Brahmaputra.

1747. (1311) **Oenopopelia tranquebarica humilis.** *The Burmese Red Turtle-Dove.*

Columba humilis *Temm., Pl. Col., pl.* 44 (1824) (*Bengal-Luzon*).

Assam S. of Brahmaputra, E. to China, Formosa, S. to Tennasserim.

1748. (1312) **Macropygia leptogrammica leptogrammica.** *The Malay Bar-tailed Cuckoo-Dove.*

Columba leptogrammica *Temm., Pl. Col., pl.* 560 (1835), (*Java*).

Tenasserim S. to Java and Sumatra.

1749 **Macropygia leptogrammica tusalia.** *The Indian Bar-tailed Cuckoo-Dove.*

Coccyzura tusalia *Hodgs., J. A. S. B., xiv., p.* 809 (1843), (*Nepal*).

Himalayas from Simla to E. Assam, Burma, Shan States and Siam.

1750. (1313) **Macropygia rufipennis.** *The Andaman Cuckoo-Dove.*

Macropygia rufipennis *Blyth, J.A.S.B., xv., p.* 371 (1846), (*Andamans.*)

Andamans and Nicobars.

1751. (1314) **Macropygia ruficeps assimilis.** *The Malay Little Cuckoo-Dove.*

Macropygia assimilis *Hume, S. F., ii., p.* 441 (1874) (*Burma*).

Burma and N. Malay Peninsula. ? Siam.

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Sub-family *Geopeliinæ.*

1752. (1315) **Geopelia striata striata.** *The Barred Ground-Dove.*

Columba striata *Linn., S. N., i., p.* 282 (1766), (*East Indies*).

S. Burma and Siam, Malay Peninsula.

Order PTEROCLETES.

Family PTEROCLIDAE.

1753. (1316) **Pterocles orientalis.** *The Large, Imperial, or Black-bellied Sand-Grouse.*

Tetrao orientalis *Linn., S.N., i., p.* 161 (1758), ("*In Oriente*").

N. Africa, S. Europe, Asia to N. W. India.

1754. (1317) **Pterocles indicus.** *The Painted Sand-Grouse.*

Tetrao indicus *Gmel., S.N., i., ii., p.* 575 (1789) (*Coromandel Coast*).

West, North-West and Central India.

1755. (1318) **Pterocles lichtensteini arabicus.** *The Arabian Close-barred Sand-Grouse.*

P. l. arabicus *Neum., Orn. Monatsb, p.* 152 (1909), (*Lahadj, S. Arabia*).

S. Arabia to India W. of the Indus.

1756. (1319) **Pterocles coronatus atratus.** *The Coronetted Sand-Grouse.*

P. c. atratus *Hartert, Bull., B.O.C., Feb.* 1902 (*East Persia*).

Syria, Arabia, Persia to N.W.India and to Mhow.

***1757.** (1320) **Pterocles alchatus caudacutus.** *The Large Pin-tailed Sand-Grouse.*

Tetrao caudacutus *Gmel., Reise de Russ.; iii., p.* 93 (1774), (*N. Persia*).

S. Russia and Western Asia to N. W. India to Delhi and Sambhar.

1758. (1321) **Pterocles senegalensis erlangeri.** *The Common Indian Sand-Grouse.*

P. exustus erlangeri *Neum., Orn. Monatsb., p.* 154 (1909), (*Lahadj, S. Arabia*).

S. Palestine, S. Arabia to India. S. to Travancore, E. to Bengal.

* Sclater, Bull, B.O.C., xlii., p. 73, 1922, has shewn that *Pteroclurus* is only a synonym for *Pterocles*. I do not propose to separate the two genera but to retain all the species under *Pterocles*.

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1759 (1322) **Pterocles senegallus.** *The Spotted Sand-Grouse.*

Tetrao senegallus *Linn., Mantissa, p.* 526 (1771) (*Senegal*).

Algeria to India, to Karachi and to Jodhpore.

1760. (1323) **Syrrhaptes tibetanus.** *The Tibetan Sand-Grouse.*

Syrrhaptes tibetanus *Gould, P.Z.S., p.* 92 (1850) (*Ladakh in Tibet*).

Tibet W. to Ladakh, S. to Sikkim.

Order GALLINÆ.

Sub-order ALECTOROPODES.

Family PHASIANIDÆ.

Sub-family *Phasianinæ.*

1761. (1324) **Pavo cristatus.** *The Common Peafowl.*

Pavo cristatus *Linn., S.N., i., p.* 267 (1766), (*India orientali*).

Ceylon, practically all India to W. Assam and Cachar.

1762. (1325) **Pavo muticus.** *The Burmese Peafowl.*

Pavo muticus *Linn., S.N., i., p.* 268 (1766), (*Java, Hartert*).

Looshai Hills, Chittagong, Burma, Siam, Cochin China, Malaya, Java.

1763. (1326) **Argusianus argus.** *The Argus Pheasant.*

Phasianus argus *Linn., S.N., i., p.* 272 (1766), (*Malacca, Hartert*).

Peninsula Burma and Siam, Malay Peninsula to Sumatra.

1764. (1327) **Polyplectron bicalcaratum bicalcaratum.** *The Indian Grey Peacock-Pheasant.*

Pavo bicalcaratus *Linn., S.N., ed. x., p.* 156 (1758) (*China in errore*), (*Cachar*).

Sub-Himalayas from Bhutan to E. Assam.

1765. **Polyplectron bicalcaratum chinquis.** *The Burmese Grey Peacock-Pheasant.*

Pavo chinquis *Mull., Suppl. Linn. S.N., p.* 121 (1776), (*China*).

Burma, N. Siam.

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1766. **Polyplectron bicalcaratum germaini.** *Germain's Peacock-Pheasant.*

Polyplectron germaini *Elliot, Ibis*, 1866, *p.* 56 (*Cochin China*).

E. Siam, Cochin China, Annam, (? Looshai Hills).

1767. **Polyplectron malaccensis.** *The Malay Peacock-Pheasant.*

Phasianus malaccensis *Scop., del, Flor. et. Faun Insubr., ii., p.* 93 (1786), (*Malacca*).

Extreme S. W. Siam and S. Burma, Malay Peninsula and Sumatra.

*1768. (1328) **Gallus gallus gallus.** *The Indian Jungle-Fowl.*

Phasianus gallus *Linn., S.N., i., p.* 158 (1758) (*Bengal, Bangs and Pennard*).

Northern India to Assam.

1769. **Gallus gallus ferrugineus.** *The Burmese Jungle-Fowl.*[!]

Gallus ferrugineus *Gmel., S.N., i., p.* 761 (1789) (*China*).

S. W. China to Burma, Siam, Malay Peninsula.

1770. **Gallus gallus bankiva.** *The Sumatran Jungle Fowl.*

Gallus bankiva *Temm., Pig. Gall., ii., p.* 87 (1813) (*Sumatra.*)

Sumatra?

1771. (1329) **Gallus sonneratii.** *The Grey Jungle-Fowl.*

Gallus sonneratii *Temm., Pig. Gall., ii., p.* 246 (1813), (*India*).

South and South-West India, Central India, N.E. to the Godavery.

1772. (1330) **Gallus lafayettii.** *The Ceylon Jungle-Fowl.*

Gallus lafayettii *Less., Traite d'Orn., p.* 491 (1831), (*Ceylon*).

Ceylon only.

1773. (1331) **Phasianus humiae humiae.** *Mrs. Hume's Pheasant.*

Callophasis humiæ *Hume, S.F., ix., p.* 461 (1881), (*Manipur*).

Naga Hills, Manipur, Looshai, Chin Hills.

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* For the name our Red Jungle-Fowls should bear see Bangs and Pennard Pro New. Eng. Zool. Club, *vii.*, p. 23 (1919), and Kloss, Journal Fed., Malay States. I accept the above only provisionally for this Catalogue.

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1774. **Phasianus humiae burmanicus.** *The Burmese Barred-backed Pheasant.*

Collophasis burmanicus *Oates, Ibis*, 1898, *p.* 124 (*Ruby Mines*).

Kachin Hills, Shan States, Yunnan and N.E. Central Burma.

1775. (1332) **Phasianus elegans.** *Stone's Pheasant.*

Phasianus elegans *Elliot, A.M.N.H.* (4), *vi., p.* 312 (1870), (*Szechuan*).

W. Szechuan to Kachin Hills, Shan States Yunnan.

1776. (1333) **Catreus wallichii** *The Cheer Pheasant.*

Phasianus wallichii *Hardw., Trans. L.S., xv., p.* 166 (1827), (*Almorah*).

Himalayas, from Hazara to Garhwal.

*1777. (1334) **Pucrasia macrolopha macrolopha.** *The Koklas or Pukras Pheasant.*

Satyra macrolopha *Less., Dic. Sci. Nat., liv., p.* 196 (1829), (*Almorah, Griffith*).

Naini Tal to Garhwal, Simla States, S. Kashmir.

1778. **Pucrasia macrolopha biddulphi.** *The Kashmir Koklas.*

Pucrasia biddulphi *Marshall, Ibis.*, 1879, *p.* 481 (*Kashmir*).

Northern Kashmir.

1779. **Pucrasia macrolopha nipalensis.** *The Nipal Koklas.*

Pucrasia nipalensis *Gould, P.Z.S.*, 1854, *p.* 100 (*Nipal*).

Western Nipal to ?Bhutan.

1780. **Pucrasia macrolopha castanea.** *The Chestnut-mantled Koklas.*

Pucrasia castanea *Gould, P.Z.S.*, 1854, *p.* 99 (*Kafiristan*).

Afghanistan and borders of N.W. Province.

1781. (1335) **Lophura rufa rufa.** *The Fire-backed Pheasant.*

Phasianus rufus *Raffles, Trans. L.S. xiii., p.* 321 (1822), (*Sumatra*).

Peninsula Siam and Burma to Sumatra.

* Mr. Chubb points out that *Phasianus pucrasia* Gray, iii, In. Zool. I., pl. 40, June 1st 1829, should have priority over *S. macrolopha* Lesson, date not recorded. As however the almost certain date of the Dict. Sci. Nat. is also 1829 I do not disturb the existing nomenclature.

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1782. **Lophura diardi.** *The Siam Fireback.*

Euplocamus diardi *Bonap., Compt. Rend., xliii., p.* 415 (1856), (*Cochin China*).

Siam, Annam, Cochin China, S. Shan States, Lao, ?Karenni.

*1783. (1336) **Gennaeus hamiltonii.** *The White-crested Kalij.*

Phasianus hamiltonii *Griff. ed. Cuv. Anim. Kingd. Aves, iii., p.* 27 (1829), (*Simla*).

Himalayas, Hazara to Kumaon.

1784. (1337) **Gennaeus leucomelanus.** *The Nepal Kalij Pheasant.*

Phasianus leucomelanus *Lath., Ind. Orn., ii., p.* 633 (1790), (*India, Nepal*).

Garhwal, Nepal and Nepal Terai.

1785. (1338) **Gennaeus melanotus.** *The Black-backed Kalij Pheasant.*

Euplocamus melanotus *Blyth, Hutton, J.A.S.B., xvii., p.* 694 (1848), (*Darjiling*).

Extreme E. Nepal, Sikkim and Bhutan.

1786. (1339) **Gennaeus horsfieldi horsfieldi.** *The Black-breasted Kalij Pheasant.*

Gallophasis horsfieldi *Gray, Gen. B., iii., p.* 498 (1845), (*India, Assam*).

Bhutan, Assam, East to the Irrawady, N. Arrakan and Chindwin.

1787. **Gennaeus horsfieldi williamsi.** *William's Kalij Pheasant.*

Gennæus williamsi *Oates. Man. Game-B., i., p.* 342 (1898), (*Kalewa, U. Chindwin*).

Area between Manipur, Yaw, Oyu and Irrawaddy R.; E. Arrakan.

1788. (1340) **Gennaeus lineatus lineatus.** *The Burmese Silver Pheasant.*

Phasianus lineatus *Vigors, P.Z.S.,* 1831, *p.* 24 (*Straits of Malacca*).

Pegu Yomas, S. and S. Central Burma S. to ? 12

1789. **Gennaeus lineatus oatesi.** *Oates' Silver Pheasant.*

Gennaeus oatesi *Ogilvie-Grant, Cat. B.M., xxii., p.* 306 (1893), (*Prome*).

S. Arrakan, N. Pegu.

* Mr. C. Chubb has kindly pointed out to me that *P. hamiltonii* of Griffith 1829 antedates *P. albocristatus* of Vigors, P.Z.S., 1830.

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1790. **Gennaeus lineatus sharpei.** *Grant's Silver Pheasant.*

Gennæus sharpei *Oates, Man. Game-B., p.* 357 (1898), (*Salween*).

E. Central Burma, North-West Siam, S. Shan States.

1791. **Gennaeus nycthemerus nycthemerus.** *The Chinese Silver Pheasant.*

Gennæus nycthemerus *Linn., S.N., ed. x., p.* 159 (1758), (*China*).

S. and S.W. China.

1792. **Gennaeus nycthemerus ripponi.** *The Yunnan Silver Pheasant.*

Gennæus ripponi *Sharpe, Bull., B.O.C., xiii., p.* 29 (1902), (*S. Shan States*).

Inter Salwin Mekong country.

1793. (1341) **Gennaeus nycthemerus rufipes.** *The Ruby-Mines Silver Pheasant.*

Gennæus rufipes *Oates, Man. Game-B., i., p.* 362 (1898), (*Ruby Mines*).

Irrawaddy Salwin District between 21° and 27° latitude.

(1342)

1794. (1343) **Lophophorus impejanus.** *The Monal.*

Phasianus impejanus *Lath., Ind. Orn., ii., p.* 632 (1790), (*India*).

Himalayas, Afghanistan to Bhutan.

1795. **Lophophorus sclateri.** *Sclater's Monal.*

Lophophorus sclateri *Jerdon, Ibis,* 1870, *p.* 148 (*Mishmi Hills.*)

Himalayas N. of Assam, Dafla to E. Abor Hills

Yunnan (Beebe).

1796. **Crossoptilon harmani.** *Elwes' Horned Pheasant.*

Crossoptilon harmani *Elwes, Ibis,* 1881, *p.* 399 (*East Tibet*).

Abor and Mishmi Hills and E. Tibet.

1797. (1344) **Tragopan satyra.** *The Crimson Tragopan.*

Meleagris satyra *Linn., S.N., ed. x., p.* 157 (1758), (*Bengal*), (*Sikkim*).

Himalayas, Garhwal to Darrang.

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1798. (1345) **Tragopan melanocephalus** *The Western Tragopan.*

Phasianus melanocephalus *Gray in Griff. ed. Cuv., iii., p.* 29 (1829), (*Almorah*).

Baghiratti River, West to Hazara.

1799. (1346) **Tragopan blythi blythi.** *The Grey-bellied Tragopan.*

Ceriornis blythi *Jerdon, P. A. S. B.*, 1870, *p.* 60 (*Assam*), (*Henema, Naga Hills*).

Hills S. of the Brahmaputra to Chin Hills.

1800. **Tragopan blythi molesworthi.** *The Tibetan Tragopan.*

T. b. molesworthi *Stuart Baker, Bull, B. O. C. xxxv., p.* 18 (1914), (*Tibet*).

Tse-la, Tawang, Tibet.

1801. **Tragopan temminckii.** *Temminck's Tragopan.*

Satyra temminckii *J. C. Gray, III. Ind. Zool., i., pl.* 50 (1830), (*China, Szechuan*).

Mishmi and Abor Hills, Tibet, Chin and Kachin Hills, Yunnan, China.

1802. (1347) **Ithagenes cruentus.** *The Blood-Pheasant.*

Phasianus cruentus *Hardw., Trans. L. S., xiii., p.* 237, (1822), (*Nepal*).

Nepal, from the Gogra, East to Bhutan.

1803. **Ithagenes kuseri.** *The Yunnan Blood-Pheasant.*

Ithaginis kuseri *Beebe, Zoologica, i.*, (10), *p.* 190 (1912), (*N. W. Yunnan*).

Mishmi and Abor Hills to Yunnan.

1804. **Ithagenes geoffroyi geoffroyi.** *Verreaux' Blood-Pheasant.*

Ithaginis geoffroyi *Verreaux, Bull Soc. d'Ac.* (2), *iv., p.* 706 (1867), (*Mupin*).

Extreme S. E. Tibet, E. of the Dong and Brahmaputra to W. China.

1805. (1348) **Ophrysia superciliosa.** *The Mountain Quail.*

Rollulus superciliosus *Gray, Knowsl. Menag. Av., pl. xvi.* (1846), (*India, Mussoorie*).

Mussoorie, Nainital.

1806. (1349) **Galloperdix spadicea spadicea.** *The Red Spur-Fowl.*

Tetrao spadiceus *Gmel., S. N., i., pt.* 2, *p.* 759 (1789), (*Madagascar, Nilgiris*).

Himalayan Terai, Central India to E. Bengal Orissa, Madras, Mysore, etc.

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1807. **Galloperdix spadicea stewarti.** *The Travancore Red Spur-Fowl.*

G. s. stewarti *Stuart Baker, Bull, B. O. C., xl., p.* 18 (1919), (*Aneichardi, Travancore*).

Travancore.

1808. **Galloperdix spadicea caurina.** *The Mt. Abu Spur-Fowl.*

Galloperdix caurina *Blanf., Avi. B. I., iv., p.* 107 (1898), (*Mt. Abu*).

Mt. Abu and surrounding country.

1809. (1350) **Galloperdix lunulata.** *The Painted Spur-Fowl.*

Perdix lunulata *Valenc. Dict. Sci. Nat., xxxviii., p.* 446 (1825), (*Bengal*).

W. Bengal, Orissa, S. to Madras Hills, Nilgiris, etc., W. to Jhansi, etc.

1810. (1351) **Galloperdix bicalcarata.** *The Ceylon Jungle-Fowl.*

Perdix bicalcaratus *Forster, Ind. Zool., p.* 25, *pl.* 14 (1781), (*Ceylon*).

Ceylon only.

1811. (1352) **Bambusicola fytchii fytchii.** *The Yunnan Bamboo Partridge.*

Bambusicola fytchii, *Anderson, P. Z. S.*, 1871, *p.* 214 (*Ponse, Yunnan*).

N. E. Burma to Yunnan and Siam.

1812. **Bambusicola fytchii hopkinsoni.** *The Assam Bamboo Partridge.*

Bambusicola hopkinsoni *Godw. Aus., P. Z. S.*, 1874, *p.* 44 (*Assam*).

Assam, S. of Brahmaputra and Western Burma.

1813. (1353) **Rollulus roulroul.** *The Green Wood Quail.*

Phasianus roulroul *Scop., Del. Flor. et Faun. Insubr., ii., p.* 93 (1786), (*Malacca*).

Tennasserim, Siam, Malay Peninsula, etc.

1814. (1354) **Excalfactoria chinensis chinensis.** *The Blue-throated Quail.*

Tetrao Chinensis *Linn., S. N., i., p.* 277 (1766) (*China*).

Ceylon, India, except N. W., to Burma, China and Malaya.

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1815. **Excalfactoria chinensis trinkutensis.** *The Trinkut Blue-throated Quail.*

Excalfactoria trinkutensis *Richmond, Pro. Nat. Mus. U. S., xxv, p.* 310 (1902), (*Trinkut*).

Is. of Trinkut and Kamorta.

1816. (1353) **Coturnix coturnix coturnix.** *The Common Quail.*

Tetrao coturnix *Linn, S. N. ed. x., p.* 161 (1758), (*Sweden*).

Europe, N. Africa, Asia, E. to Lake Baikal and India.

1817. **Coturnix coturnix japonica.** *The Japanese Quail.*

Coturnix japonica *Temm. and Schleg., Faun. Jap., p.* 103 (1842), (*Japan*).

East Siberia to Japan. Winter S. to China and India (Assam and Burma).

1818. (1356) **Coturnix coramandelica.** *The Black-breasted or Rain-Quail.*

Tetrao coramandelicus *Gmel., S. N., i., p.* 764 (1789) (*Coramandel Coast*).

Throughout India to. E. Assam and N. Burma.

1819. (1357) **Perdicula asiatica.** *The Jungle Bush-Quail.*

Perdix asiatica *Lath., Ind. Orn., ii., p.* 649 (1790), (*Mahratta region*).

Ceylon and the whole of India, N. to the Jodhpur Hills and E. Bengal.

1820. (1358) **Perdicula argoondah.** *The Rock Bush-Quail.*

Coturnix argoondah *Sykes, P. Z. S.*, 1832, *p.* 153, (*Deccan*).

N. W. Provinces, Punjab through W. Central Provinces to E. Travancore.

1821. (1359) **Coryptoplectron erythrorhynchus erythrorhynchus.** *The Painted Bush-Quail.*

Coturnix erythrorhyncha *Sykes, P. Z. S.*, 1832, *p.* 153 (*N. Konkan*).

Western Ghats from Bombay to Travancore.

1822. (1360) **Coryptoplectron erythrorhynchus blewitti.** *Blewitt's Bush-Quail.*

Microperdix blewitti *Hume, S. F., ii., p.* 512 (1874) (*Karial, Raipur*).

Eastern Central Provinces to Eastern Benga'

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1823. (1361) **Microperdix manipurensis manipurensis.** *The Manipur Bush-Quail.*

Perdicula manipurensis *Hume, S. F., ix., p.* 467 (1880), *E.* (*Manipur*).

Manipur, Cachar.

1824. **Microperdix manipurensis inglisi.** *Inglis' Bush-Quail.*

Microperdix inglisi *Ogilvie-Grant, B. N. H. Jour., xix, p.* 1 (1909), (*Goalpara*).

Goalpara.

1825. (1362) **Arboricola torqueola torqueola.** *The Common Hill-Partridge.*

Perdix torqueola *Valenc., Dict. Sci. Nat., xxxviii., p.* 435 (1825), (*Bengal*).

Garhwal to E. Assam, N. and S. of the Brahmaputra.

1826. **Arboricola torqueola batemani.** *Ogilvie-Grant's Hill-Partridge.*

Arboricola batemani *Ogilvie-Grant, Bull. B. O. C. xvi., p.* 68 (1906), (*Chin Hills*).

Chin and Kachin Hills.

1827. **Arboricola torqueola millardi.** *The Simla Hill-Partridge.*

A. t. millardi *Stuart Baker, Bull, B. O. C., xli., p.* 101 (1921), (*Koteghur*).

Simla Hills to Chamba, Kullu and Kangra.

1828. (1363) **Arboricola rufogularis rufogularis.** *Blyth's or the Rufous-throated Hill-Partridge.*

Arboricola rufogularis *Blyth, J. A. S. B., xviii., p.* 819 (1849), (*Sikkim*).

Kumaon and Garhwal to E. Assam, N. of the Brahmaputra.

1829. (1364) **Arboricola rufogularis intermedia.** *The Arrakan Hill-Partridge.*

Arboricola intermedia *Blyth, J. A. S. B., xxiv., p.* 277 (1856), (*Arrakan*).

Assam, S. of the Brahmaputra, Chin, Kachin Hills and Arrakan.

1830. **Arboricola rufogularis tickelli.** *Tickell's Red throated Hill-Partridge.*

Arboricola tickelli *Hume, Game-B., ii., p.* 77 (1880), (*Mooleyit, Tenasserim*).

Tennasserim, S. Shan States, ? E. and S. Siam and N. Malay States.

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1831. (1365) **Arboricola atrogularis.** *The White-cheeked Hill-Partridge.*

Arboricola atrogularis *Blyth, J.A.S.B., xviii., p.* 819 (1849), (*Assam*).

Assam, S. and N. E. of the Brahmaputra, Chin and Kachin Hills, Arrakan.

1832. (1366) **Arboricola mandellii.** *The Red-breasted Hill-Partridge.*

Arborophila mandellii *Hume, S. F., ii, p.* 449 (1874) (*Bhutan Duars*).

Hills N. of the Brahmaputra from Sikkim to E. Assam.

1833. (1367) **Arboricola brunneopecta brunneopecta.** *The Brown-breasted Hill-Partridge.*

Arboricola brunneopectus *Tick., Blyth, J. A. S. B. xxiv., p.* 276 (1855), (*Tennasserim*).

Pegu and Eastern Burma, N. W. Siam and S. Shan States.

1834. (1368) **Tropicoperdix charltoni charltoni.** *The Malay Green-legged Hill-Partridge.*

Perdix charltoni *Eyton, A. M. N. H. (1), xvi., p.* 230 (1845), (*Malacca*).

Peninsular Siam (Gyldenstolpe), ? S. Tennasserim, Malay Pen. to Borneo.

1835. **Tropicoperdix charltoni chloropus.** *The Green-legged Hill-Partridge.*

Tropicoperdix chloropus *Tick, J. A. S. B., xxiv. p.* 415 (1859), (*Tennasserim*).

Tennasserim, Eastern Burma to Bhamo Hills, W. Siam, W. Shan States.

1836. (1369) **Caloperdix oculea oculea.** *The Ferruginous Wood-Partridge.*

Perdix oculea *Temm., Pig. Gall. iii., pp.* 408, 732 (1815), (*Sumatra*).

Sumatra to Tennasserim and S. W. Siam.

837. **Rhizothera longirostris.** *The Long-billed Wood Partridge.*

Perdix longirostris *Temm., Pig. Gall., iii., p.* 323 (1815), (*N. Sumatra*).

Peninsular Siam and Burma to Sumatra and W Borneo.

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*1838. (1370) **Alectoris græca chukar.** *The Chukar.*

Perdix chukar *Gray, Hardw. Ill. In. Zool., i., pl.* 54 (1830-32), (*India, Nepal*).

Hills of N. India and Himalayas, E. to Tibet and Sikkim.

1839. (1370) **Alectoris græca pallescens.** *The Northern Chukar.*

Caccabis pallescens *Hume, Lahore to Yar., p.* 283 (1873), (*Karbu in Ladak*).

Turkestan to extreme N. Kashmir and Ladak.

1840. (1370) **Alectoris græca koriakovi.** *The Persian Chukar.*

Caccabis kakelik koriakovi *Zarudny, Mess. Orn., p.* 55 (1914), (*E. Persia*).

E. Persia to Baluchistan, ? Sind and Quetta.

1841. (1371) **Ammoperdix griseogularis griseogularis.** *The See-see Partridge.*

Perdix griseogularis *Brandt, Bull. Acad. St. Peters., p.* 365 (1843), (*Transcaspia*).

? Arabia, Persia, Transcaspia to Baluchistan, Afghanistan, Sind, Punjab.

1842. (1372) **Francolinus francolinus asiæ.** *The Northern Indian Black Partridge.*

Francolinus asiæ *Bonap., Compt. Rend., xlii., p.* 882 (1856), (*Asia*), (*Gurgaon*).

N. India to W. Nepal; S. to Deesa, Sambhur, etc., E. to Chota Nagpore.

1843. (1372) **Francolinus francolinus henrici.** *The South Persian Black Partridge.*

Francolinus henrici *Bonap., Compt. Rend., xlii., p.* 882 (1856), (*Sind*).

S. and E. Persia to Baluchistan, Afghanistan and Sind.

1844. (1372) **Francolinus francolinus melanonotus.** *The Assam Black Partridge.*

Francolinus melanonotus *Hume, S. F., xi., p.* 305 (1888), (*Assam*).

Nepal to E. Assam, Central and W. Bengal.

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* For a review of the genera *Alectoris* (*Caccabis*) and *Ammoperdix*, see Hartert. Nov. Zool. *xxiv.*, p. 276 (1917). For *Francolinus* ibid, p. 288.

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1845. (1373) **Francolinus pictus pictus.** *The Southern Painted Partridge.*

Perdix picta *Jard. & Scl., Ill. Orn., pl.* 50 (1828), (*Bangalore*).

Ceylon and S. India, N. to Khandesh, Raipur and Behar.

1846. (1373) **Francolinus pictus pallidus.** *The Northern Painted Partridge.*

Perdix hepburni *var* pallida *Gray, Ill. In. Zool., i., pl.* 55 (1830-32), (*Odypore*).

India, N. and W. of the preceding bird.

1847. (1374) **Francolinus chinensis.** *The Eastern or Chinese Francolin.*

Tetrao chinensis *Osbeck, Voyage en Chine, ii., p.* 326 (1771), (*China*).

South China to Chin Hills and Pegu. Hainan, Siam, etc.

1848. (1375) **Francolinus pondicerianus pondicerianus.** *The Southern Grey Partridge.*

Tetrao pondicerianus *Gmel., S. N., i.,* 2, *p.* 760 (1789), (*Pondicherry*).

South India and Ceylon.

1849. (1375) **Francolinus francolinus interpositus.** *The Northern Grey Partridge.*

F. f. interpositus *Hartert, Nov. Zool., xxiv., p.* 288 (1917), (*Oudh*).

N. W. India to Behar.

1850. (1375) **Francolinus francolinus mecranensis.** *The Sind Grey Partridge.*

Francolinus mecranensis *Zarud. & Harm., Orn. Monatsb., p.* 53 (1913), (*Baluchistan*).

South Persia, Afghanistan, Baluchistan to Sind.

1851. (1376) **Francolinus gularis.** *The Kyah or Swamp Partridge.*

Perdix gularis *Temm., Pig. Gall., iii., p.* 401 (1815), (*India*), (*Cachar*).

Eastern Bengal, Behar and Assam.

1852. (1377) **Perdix hodgsoniæ hodgsoniæ.** *The Tibetan Partridge.*

Sæfa hodgsoniæ *Hodgs., J. A. S. B., xxv., p.* 165 (1857), (*Tibet*).

Tibet plateau N. of Sikkim and Nepal W. to Hanle.

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1853. (1378) **Tetraogallus himalayensis himalayensis.** *The Himalayan Snow-Cock.*

T. himalayensis *Gray, P. Z. S.*, 1842, *p.* 105 (*Himalayas*).

Western Himalayas, Pamirs, to Bochara and Turkestan.

1854. (1379) **Tetraogallus tibetanus tibetanus.** *The Ladak Snow-Cock.*

T. tibetanus *Gould, P. Z. S.*, 1853, *p.* 47 (*Ladak*).

Extreme N. E. Kashmir, Ladak, W. Tibet, Yarkand, Kashgar.

1855. (1379) **Tetraogallus tibetanus przewalskii.** *The East Tibet Snow-Cock.*

T. t. przewalskii *Bianchi, Aves Exped. Mong. Tibet, p.* 165 (1907), (*E. Tibet*).

S. and E. Tibet to Kansu and Nan-Schan.

1856. (1380) **Lerwa lerwa.** *The Snow Partridge.*

Perdix lerwa *Hodgs., P. Z. S.*, 1833, *p.* 107 (*N. region of Nepal*).

Himalayas from W. Kashmir to W. China.

Sub-order PERISTEROPODES.

Family MEGAPODIDÆ.

1857. (1381) **Megapodius nicobariensis.** *The Nicobar Megapode.*

M. nicobariensis *Blyth, J. A. S. B., xv., p.* 52 (1846), (*Nicobars*).

Nicobars, Car Nicobar, Battye Malve.

Order HEMIPODII.

Family TURNICIDÆ.

*1858. (1382) **Turnix javanica leggei.** *The Ceylon Bustard-Quail.*

T. j. leggei *Stuart Baker, Bull. B. O. C., xliii., p.* 9 (1920), (*Ceylon*).

Ceylon only.

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* *Pugnax* of Temminck (1815) is antedated by *Javanica* of Rafinesque (1814).

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1859. (1382) **Turnix javanica plumbipes.** *The Burmese Bustard-Quail.*

Hemipodius plumbipes *Hodgs., Beng. Sport. Mag.*, 1837, *p.* 346 (*Nepal*).

Nepal to E. Assam, Burma, W. Siam, Fed, Malay States.

1860. (1382) **Turnix javanica taijoor.** *The Common Bustard-Quail.*

Hemipodius taijoor *Sykes, P. Z. S.*, 1832, *p.* 155 (*Deccan*).

The whole of India S. & W. of the range of *plumbipes*.

1861. (1382) **Turnix javanica rostrata.** *The Chinese Bustard-Quail.*

Turnix rostrata *Swinh., Ibis*, 1865, *p.* 542 (*China*).

Formosa, and thence through S. China to Yunnan and Shan States.

1862. (1383) **Turnix dussumieri.** *The Little Button-Quail.*

Hemipodius dussumieri *Temm., Pl. Col., v., p.* 454 (1828), (*India*).

All India, Burma, Siam, Formosa, Hainan.

1863. (1384) (1385) **Turnix tanki tanki.** *The Indian Button-Quail.*

Turnix tanki *Blyth, J. A. S. B.. xii., p.* 180 (1843).

All India, N. E. to Assam N. of the Brahmaputra.

1864. (1386) **Turnix tanki blanfordi.** *The Burmese Button-Quail.*

Turnix blanfordi *Blyth, J. A. S. B., xxii., p.* 80 (1843), (*Thayetmyo, Burma*).

Burma, Siam, China to Manchuria and N. W. to Assam S. of the Brahmaputra.

Order GRALLÆ.

Sub-order FULICARIÆ.

Family RALLIDÆ.

1865. (1387) **Rallus aquaticus aquaticus.** *The Water Rail.*

Rallus aquaticus *Linn., S. N., i., p.* 153 (1758), (*Great Britain*).

Straggler in winter into N. W. India.

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1866. (1387) **Rallus aquaticus indicus.** *The Indian Water Rail.*

Rallus indicus *Blyth, J. A. S. B., xviii., p.* 820 (1849), (*Bengal*).

Japan, East Siberia, N. China to Himalayas; S. in winter.

1867. **Rallus aquaticus korejewi.**

Sarudny, Orn. Monatsb., p. 209 (1905), (*E. Turkestan*).

A common winter visitor to N. W. India, ? Breeding Kashmir (Livesey).

*1868. (1389) **Hypotaenidia striata striata.** *The Blue-breasted Banded Rail.*

Rallus striatus *Linn., S. N., i., p.* 262 (1766), (*Philippines*).

Ceylon, India, N. and Central Burma.

1869. (1390) **Hypotaenidia striata obscuriora.** *The Andamanese Banded Rail.*

Hypotænidia obscuriora *Hume, S. F., ii., p.* 302 (1874), (*Andamans*).

Andaman Islands.

1870. (1391) **Crex crex.** *The Corn-Crake or Land-Rail.*

Rallus crex *Linn., S. N., i., p.* 153 (1758), (*Sweden*).

A rare straggler into N. W. India in winter.

1871. (1392) **Porzana parva.** *The Little Crake.*

Rallus parvus *Scop., Ann. I. Hist. Nat., p.* 108 (1769) (*Kärnthen*).

A common winter visitor to N. W. India.

1872. (1393) **Porzana pusilla pusilla.** *The Eastern Baillons Crake.*

Rallus pusillus *Pallas, Reis. Russ. Reich., iii., p.* 700 (1776), (*Dauria*).

Throughout Ceylon, India, Burma and E. Asia generally.

1873. **Porzana pusilla intermedia.** *Western Baillons Crake.*

Rallus intermedius *Herm., Obs. Zool., p* 198 (1804), (*Strasburgh*).

Europe, much of Africa. ? Deesa.

1874. (1394) **Porzana porzana.** *The Spotted Crake.*

Rallus porzana *Linn, S. N., i., p.* 262 (1766), (*France*).

A winter visitor to N. and Central India and N. Burma.

* I have not worked out this species and its variations.

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1875. (1395) **Rallina superciliaris.** *The Banded Crake.*

Rallus superciliaris *Eyton, A. M. N. H., xvi., p.* 230 (1844), (*Malay Peninsula*).

Throughout Ceylon, India, Burma, Siam, Malay Peninsula.

1876. (1396) **Rallina fasciata.** *The Malayan Banded Crake.*

Rallus fasciatus *Raffi., Trans. L. S., xiii., p.* 328 (1822), (*Malay*).

Assam, Burma, Siam, etc.

1877. (1397) **Rallina canningi.** *The Andamanese Banded Crake*

Euryzona canningi (*Tytler*) *Blyth, Ibis,* 1863, *p.* 119 (*Port Canning, Andamans*).

Andamans.

1878. (1398) **Amaurornis fuscus fuscus.** *The Ruddy Crake.*

Rallus fuscus *Linn,, S. N., i., p.* 262 (1766), (*Philippines*).

S. India, Ceylon, Philippines, Borneo, Sumatra, etc.

1879 (1398) **Amaurornis fuscus bakeri.** *The Northern Ruddy Crake.*

Porzana fusca bakeri *Hartert, Nov. Zool.,* 1917, *p.* 272 (*Bhim-tal*).

Northern India and Burma.

1880. (1398) **Amaurornis fuscus erythrothorax.** *The Eastern Ruddy Crake.*

Gallinula erythrothorax *Temm. and Schl., Faun. Jap., p.* 121 (1849), (*Japan*).

A rare straggler into extreme N. E. Burma; Japan to Yunnan and Siam.

1881. (1399) **Amaurornis bicolor.** *Elwes' Crake.*

Porzana bicolor *Wald., A. M. N. H.,* (4) *ix., p.* 47 (1872), (*Sikkim*).

Nepal and Sikkim to E. Assam, N. and S. of the Brahmaputra.

1882. (1400) **Amaurornis akool.** *The Brown Crake.*

Rallus akool *Sykes, P. Z. S.,* 1832, *p.* 164 (*Deccan*).

N. and Central India, S. to the Deccan and Mysore.

*1883. (1401) **Amaurornis phœnicura phœnicura.** *The Ceylon White-breasted Water-Hen.*

Rallus phœnicurus *Pennant, Ind. Zool., ix., p.* 10 (1769), (*Ceylon*).

Ceylon and Travancore.

* See Stresemann Nov. Zool., xx., p. 305, 1913.

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1884. (1401) **Amaurornis phœnicura chinensis.** *The Chinese White-breasted Water-Hen.*

Fulica chinensis *Boddaert, Tabl. Pl. Enl., p.* 54 (1783), (*China*).

India, Burma, China, etc.

1885. (1401) **Amaurornis phœnicura insularis.** *The Andaman White-breasted Water-Hen.*

A. insularis *Sharpe, Cat. B. M., xxiii., p.* 163 (1894), (*Andamans*).

Andamans.

1886. (1402) **Gallinula chloropus parvifrons.** *The Indian Moorhen.*

Gallinula parvifrons *Blyth, J. A. S. B., xii., p.* 180 (1843), (*Calcutta*).

Practically the whole of India and Ceylon.

1887. (1403) **Gallicrex cinerea.** *The Kora or Water-Cock.*

Fulica cinerea *Gmel., S. N., i., p.* 702 (1789), (*China*).

Ceylon, India East to China, Japan and to Philippines.

1888. (1404) **Porphyrio poliocephalus poliocephalus.** *The Indian Purple Coot.*

Gallinula poliocephala *Lath., Ind. Orn. Suppl., p.* 68 (1801), (*India*).

India, Ceylon, Burma, Siam.

1889. (1405) **Fulica atra atra.** *The Common Coot.*

Fulica atra *Linn., S. N., i., p.* 151 (1758), (*Sweden*).

Europe, Africa, Asia. All India.

Family HELIORNITHIDÆ.

1890. (1406) **Heliopais personata.** *The Masked Finfoot.*

Podica personata *Gray., P. Z. S.,* 1848, *p.* 90 (*Malacca*).

Assam, Burma and Malay Peninsula to Sumatra.

Sub-order MEGALORNES.

Family MEGALORNITHIDÆ.

1891. (1407) **Megalornis grus lilfordi.** *The Eastern Crane.*

Grus lilfordi *Sharpe, Cat. B. M., xxiii., p.* 252 (1894), (*E. Siberia.*)

Eastern Siberia, wintering in N. W. India.

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1892. **Megalornis nigricollis.** *The Black-necked Crane.*

Grus nigricollis *Przewalski, Mongol. Tang., ii., p.* 135 (1876), (*Koko-Nur*).

Tibet to the Koko-Nor.

1893. **Megalornis monachus.** *The Hooded Crane.*

Grus monacha *Temm., Pl. Col.*, 555 (1835), (*Yesso and Corea*).

A rare straggler into India. (Assam and Manipur.)

1894. (1408) **Megalornis leucogeranus.** *The Great White or Siberian Crane.*

Grus leucogeranus *Pallas, Reise Reich. Russ., ii., p.* 714 (1773), (*Irtin and Ob Rivers*).

Rare visitor to N. W. Ind.

1895. (1409) **Megalornis antigone antigone.** *The Sarus Crane.*

Ardea antigone *Linn., S. N., i., p.* 142 (1758), (*Indian Hartert*).

Northern India to W. Assam.

1896. (1410) **Megalornis antigone sharpii.** *The Burmese Sarus.*

Grus sharpii *Blanf., Bull. B. O. C., v., p. vii.* (1895), (*Burma*).

Assam, E. and S. of the Brahmaputra, Burma and Siam.

1897. (1411) **Anthropoides virgo.** *The Demoiselle Crane.*

Ardea virgo *Linn., S. N., i., p.* 141 (1758), (*In Oriente*).

E. Europe and W. Asia, wintering N. E. Africa and India.

Sub-order OTIDES.

Family OTIDIDÆ.

*1898. (1412) **Otis tarda tarda.** *The Great Bustard.*

Otis tarda *Linn., S. N., i., p.* 154 (1758), (*Poland*).

Rare straggler into N. W. India. Europe and W. Asia.

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* Sarudny separates the Turkestan (and Indian) bird as *O. t. korejewi.* I cannot divide them.

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1899. (1413) **Tetrax tetrax orientalis.** *The Eastern Little Bustard.*

O. t. orientalis *Hartert, Nov. Zool., xxiii., p.* 339, (1916), (*Sarepta*).

S. E. Russia, W. Siberia and Central Asia. Winter visitor to India.

1900. (1414) **Choriotes edwardsi.** *The Great Indian Bustard.*

Otis edwardsi, *Gray in Hardw., Ill. In. Zool., i., pl.* 50 (1830-2), (*no locality*) (*Khatiawar*).

N. W. India. E. to Shahabad and Gaza, S. to about 11°.

1901. (1415) **Chlamydotis undulata macqueeni.** *Macqueen's Bustard or Houbara.*

Otis macqueeni *Gray, Op. cit., pl.* 47, (*Himalayas*).

N. W. India to a little E. of the Jamna. S. E. Europe and W. Asia.

*1902. (1416) **Sypheotides indica.** *The Lesser Florican or Likh.*

Otis indica *Gmel., S. N., i., p.* 725 (1789), (*India*).

The greater part of India in suitable localities. E. to W. Bengal and Behar.

1903. (1417) **Sypheotides bengalensis.** *The Bengal Florican.*

Otis bengalensis *Gmel., S. N., i., p.* 724 (1789), (*Bengal*).

Bengal and Assam N. and E. of Ganges.

Order LIMICOLÆ.

Family BURHINIDÆ.

1904. (1418) **Burhinus oedicnemus indicus.** *The Indian Stone-Curlew.*

Oedicnemus indicus, *Salva., Att. Soc. Ital. Sci. Nat., vii., p.* 381 (1866), (*India*).

Practically throughout Ceylon, India, Burma and Siam.

1905. (1418) **Burhinus œdicnemus astutus.** *The Sind Stone-Curlew.*

Hartert, Nov. Zool. xxiii., p. 93 (1916), (*Fao, Persia*).

Transcaspia, E. Persia, Baluchistan and Sind.

* Mr. Iredale points out to me that Gmelin's name *indica* is founded on the plate of Miller. This is undoubtedly *Sypheotes aurita* and therefore *indica* must be retained.

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1906. (1419) **Esacus recurvirostris.** *The Great Stone-Plover.*

Oedicnemus recurvirostris *Cuv., Regne., Ani., i., p.* 500 (1829), (*India*).

Ceylon, India and Burma to Siam.

1907. (1420) **Orthoramphus magnirostris.** *The Australian Stone-Plover.*

Oedicnemus magnirostris *Vieill., Nouv. Dict. d'Hist. Nat., xxiii., p.* 231 (1818).

Andamans and Cocos. Thence through Malay Arch. to Australia.

Family DROMADIDÆ.

1908. (1421) **Dromas ardeola.** *The Crab Plover.*

Dromas ardeola *Paykull, K. Svensk. Vet. Ak. Hand-l. xxvi., p.* 182 (1845), (*India*).

Shores of Indian Ocean W. of Malay Arch.

Family GLAREOLIDÆ.

1909. (1422) **Cusorius coromandelicus.** *The Indian Courser.*

Charadrius coromandelicus *Gmel., S.N., i., p.* 692 (1788), (*Coromandel Coast*).

India and Ceylon.

1910. (1423) **Cursorius gallicus jamesoni.** *The Eastern Cream-coloured Courser.*

Cursorius jamesoni *Jerd., B. of I. App., p.* 875 (1877) (*Punjab*).

N. W. India, Punjab and Sind. Transcaspia, N. and E. Persia.

1911. (1424) **Rhinoptilus bitorquatus.** *Jerdon's Courser.*

Macrotarsius bitorquatus *Jerd., Blyth, J.A.S.B., xvii., p.* 224 (1848), (*E. Ghats*).

Madras, Nellore, Cuddapah, Sironcha, Badrachalam.

1912. (1425) **Glareola maldivarum.** *The Large Indian Swallow-Plover.*

Glareola maldivarum *Forster, Faun. Ind., p.* 11 (1795), (*Maldives*).

Ceylon, India, Burma, Siam to China, etc.

1913. (1426) **Glareola pratincola pratincola.** *The Collared Pratincole.*

Hirundo pratincola *Linn., S.N., i., p.* 345 (1766), (*Austria*).

Europe, N. Africa, Asia to N. W. India.

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1914. (1427) **Glareola lactea.** *The Small Indian Pratincole or Swallow-Plover.*

Glareola lactea *Temm., Man. d'Orn., ed.* 2, *ii., p.* 503 (1820), (*Bengal*).

Ceylon, India, Burma and Siam

Family JACANIDÆ.

1915. (1428) **Metopidius indicus.** *The Bronze-winged Jacana.*

Parra indica *Lath., Ind. Orn., ii., p.* 765 (1790), (*India*).

India, Burma, Siam, Malay Pen., Sumatra, Java to Celebes.

1916. (1429) **Hydrophasianus chirurgus.** *The Pheasant-tailed Jacana.*

Tringa chirurgus *Scop., Del. Flor. et Faun. Insubr., ii., p.* 92 (1786), (*New Guinea*).

India, Burma, Ceylon, Siam, South China, Malay P. to Java, etc.

Family CHARADRIIDÆ.*

Sub-family *Charadriinæ.*

1917. (1430) **Arenaria interpres interpres.** *The Turnstone.*

Tringa interpres *Linn., S.N., i., p.* 148 (1758), (*Sweden*).

Winter visitor to India. S. to Ceylon. E. to Siam, etc.

1918. (1431) **Lobivanellus indicus indicus.** *The Indian Red-wattled Lapwing.*

Tringa indica *Bodd., Pl. Enl., p.* 50 (1783), (*Goa*).

India and Ceylon.

1919. (1432) **Lobivanellus indicus atronuchalis.** *The Burmese Red-wattled Lapwing.*

Lobivanellus atronuchalis *Blyth, Jerd., B. of I., iiii., p.* 648 (1864), (*Burma*).

Assam S. of the Brahmaputra to Siam, Cochin China, Malay P., etc.

1920. (1433) **Sarciophorus malabaricus.** *The Yellow-wattled Lapwing.*

Charadrius malabaricus *Bodd., Pl. Enl., p.* 53 (1783 (*Malabar Coast*).

India and Ceylon generally, E. to E. Assam.

* This paper does not attempt to deal with the question of Families and Sub-families which are left, pending further investigation, as in Blanford and Oates.

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1906. (1419) **Esacus recurvirostris.** *The Great Stone-Plover.*

Oedicnemus recurvirostris *Cuv., Regne., Ani., i., p.* 500 (1829), (*India*).

Ceylon, India and Burma to Siam.

1907. (1420) **Orthoramphus magnirostris.** *The Australian Stone-Plover.*

Oedicnemus magnirostris *Vieill., Nouv. Dict. d'Hist. Nat., xxiii., p.* 231 (1818).

Andamans and Cocos. Thence through Malay Arch. to Australia.

Family DROMADIDÆ.

1908. (1421) **Dromas ardeola.** *The Crab Plover.*

Dromas ardeola *Paykull, K. Svensk. Vet. Ak. Hand-l. xxvi., p.* 182 (1845), (*India*).

Shores of Indian Ocean W. of Malay Arch.

Family GLAREOLIDÆ.

1909. (1422) **Cusorius coromandelicus.** *The Indian Courser.*

Charadrius coromandelicus *Gmel., S.N., i., p.* 692 (1788), (*Coromandel Coast*).

India and Ceylon.

1910. (1423) **Cursorius gallicus jamesoni.** *The Eastern Cream-coloured Courser.*

Cursorius jamesoni *Jerd., B. of I. App., p.* 875 (1877) (*Punjab*).

N. W. India, Punjab and Sind. Transcaspia, N. and E. Persia.

1911. (1424) **Rhinoptilus bitorquatus.** *Jerdon's Courser.*

Macrotarsius bitorquatus *Jerd., Blyth, J.A.S.B., xvii., p.* 224 (1848), (*E. Ghats*).

Madras, Nellore, Cuddapah, Sironcha, Badrachalam.

1912. (1425) **Glareola maldivarum.** *The Large Indian Swallow-Plover.*

Glareola maldivarum *Forster, Faun. Ind., p.* 11 (1795), (*Maldives*).

Ceylon, India, Burma, Siam to China, etc.

1913. (1426) **Glareola pratincola pratincola.** *The Collared Pratincole.*

Hirundo pratincola *Linn., S.N., i., p.* 345 (1766), (*Austria*).

Europe, N. Africa, Asia to N. W. India.

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1921. (1434) **Microsarcops cinereus.** *The Grey-headed Lapwing.*

Pluvianus cinereus *Blyth, J.A.S.B., xi., p.* 587 (1842), (*Calcutta*).

N. China, Mongolia, Japan. In winter, S. to India, etc.

1922. (1435) **Hoplopterus ventralis.** *The Spur-winged Plover.*

Charadrius ventralis *Wagl., Syst. Av., No. ii.* (1827), (*Java*).

N. E. India, Burma, Siam and S. China.

1923. (1436) **Vanellus vanellus.** *The Lapwing, Peewit or Green Plover.*

Tringa vanellus *Linn., S.N., i., p.* 148 (1758), (*Sweden*).

Fairly common from N. W. India to Assam and Burma (once).

1924. (1437) **Chettusia gregaria.** *The Sociable Plover.*

Charadrius gregarius *Pall., Reise. Reichs. Russ., i., p.* 456 (1771), (*Volga*).

E. and S. E. Russia and Central Asia. Northern and Central India in winter.

1925. (1438) **Chettusia leucura.** *The White-tailed Lapwing.*

Charadrius leucurus *Licht. in Eversm. Reise. av. Orenb.nach Buchara, p.* 137 (1823), (*Kuwan*).

Syria, Persia, Mesopotamia, Turkestan. Winter in India.

1926. (1441) **Squatarola squatarola hypomelana.** *The Eastern Grey Plover.*

Charadrius hypomelanus *Pall., Reise., Russ. Reichs. iii., p.* 699 (1776), (*Siberia*).

Siberia from Taimyr to Alaska. Winter to India, Ceylon, etc.

*1927. (1439) **Pluvialis dominicus fulvus.** *The Eastern Golden Plover.*

Charadrius fulvus *Gmel., S.N., i.*, 2, *p.* 687 (1789) (*Tahiti*).

Breeding Siberia and wintering S. Asia, India, Ceylon, etc.

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* As the generic name *Charadrius* is applicable to the Ring Plovers, etc., we cannot use it for the Golden Plover. The next name available is *Pluvialis* Brisson Ornith, *v.* p. 42, 1700.

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1928. (1440) **Pluvialis apricarius.** *The Golden Plover.*

Charadrius apricarius *Linn., S.N., i., p.* 150 (1758), (*Oland*).

Breeding N. Europe, straggler only into N. W. India.

1929. (1442) **Charadrius leschenaulti.** *The Large Sand-Plover.*

Charadrius leschenaulti *Less., Dict. Sci. Nat., xlii. p.* 36 (1826), (*Pondicherry*).

Winter, Sea-coasts of India, Burma and Ceylon.

1930. (1443) **Charadrius mongolus mongolus.** *The Mongolian Lesser Sand-Plover.*

Charadrius mongolus *Pall., Reise. Reiches. Russ., iii., p.* 700 (1776), (*Mongolia*).

Breeding Mongolia and E. Siberia, winter to India, etc.

1931. (1443) **Charadrius mongolus atrifrons.** *The Central Asian Lesser Sand-Plover.*

Charadrius atrifrons *Wagler, Isis,* 1829, *p.* 650 (*Bengal*).

Breeding Central Asia. Winter to India, etc.

1932. (1444) **Charadrius asiaticus asiaticus.** *The Caspian Sand-Plover.*

Charadrius asiaticus *Pall., Reise. Reichs. Russ., ii., p.* 715 (1773), (*S. Arctic Steppes*).

Breeding Caspia to Central Asia. India, Ratnagiri.

1933. (1445) **Charadrius veredus.** *The Eastern Sand-Plover or Dotterel.*

Charadrius veredus *Gould, P.Z.S.,* 1848, *p.* 38 (*N. Australia*).

Breeds N. China and Mongolia, winters South Andamans.

1934. (1447) **Charadrius dubius dubius.** *The Little Ringed-Plover.*

Charadrius dubius *Scop. Del. Flor. et Faun. Insubr. ii., p.* 93 (1786), (*Luzon*).

South China to Philippines (? Tennasserim).

1935. (1447) **Charadrius dubius jerdoni.** *Jerdon's Little Ringed-Plover.*

Agialitis jerdoni *Legge, P.Z.S., i., p.* 125 (1831), (*Ganges*).

Throughout India.

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1936. (1448) **Charadrius dubius curonicus.** *The European Little Ringed-Plover.*

Charadrius curonicus *Gmel., S.N., i., 2, p.* 692 (1789), (*Curonia*).

Breeding Europe, winter in India.

*1937. (1449) **Charadrius hiaticula tundræ.** *The Eastern Ringed-Plover.*

Ægialitis hiaticula tundræ *Lowe, Bull. B.O.C., xxxvi, p.* 7 (1915), (*Yennesei*).

1938. (1450) **Charadrius placidus.** *The Long-billed Ringed-Plover.*

Charadrius placidus *Gray, Cat. Mam., etc. Coll. Hodg., p.* 70 (1863), (*Nepal*).

Breeding N. E. Asia. Winter casual to N. E. India, Nepal to Assam and Burma.

1939. (1446) **Charadrius alexandrinus alexandrinus.** *The Kentish-Plover.*

Charadrius alexandrinus *Linn., S. N., i., p.* 160 (1758), (*Egypt*).

Breeding Europe, N. Africa, N. Asia, etc., Winter, S. Asia.

1940. (1446) **Charadrius alexandrinus seebohmi.** *The Indian Kentish-Plover.*

C. a. seebohmi *Hartert and Jackson, Ibis,* 1915, *p.* 529 (*Ceylon*).

Shores of Red Sea, Ceylon.

1941. (1446) **Charadrius alexandrinus dealbatus.** *The Chinese Kentish-Plover.*

Agialites dealbatus *Swinh., P. Z. S.,* 1870, *p.* 138 (*China*).

Japan and China. Straggler Burma.

1942. (1446) **Charadrius alexandrinus peroni.** *The Bornean Kentish-Plover.*

Charadrius peroni *Schleg., Mus. Pay-Bas, sp.* 33 (1865), (*Borneo.*)

Resident Malay Coasts and Borneo. Extreme S. Tennasserim.

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* The type of the Genus *Charadrius* is *hiaticula*. If the Northern Sand-Plovers be removed from this genus they would bear the name *Cirrepedesmus*.

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Sub-family HÆMATOPIDÆ.

1943. (1450) **Hæmatopus ostralegus ostralegus.** *The Oyster-catcher.*

Hæmatopus ostralegus *Linn., S.N., i., p.* 152 (1758), (*Oland*).

Breeding N. Europe. India in winter.

1944. (1450). **Hæmatopus ostralegus longipes.** *The Siberian Oyster-catcher.*

H. o. longipes *Buturlin, Men. Orn.*, 1910, *p.* 36 (*Caspian Basin*).

Breeding Siberia, wintering South. Common India.

1945. (1451) **Hæmatopus ostralegus osculans.** *The Chinese Oyster-catcher.*

Hæmatopus osculans *Swinh., P. Z. S.*, 1871, *p.* 405 (*N. China*).

Breeding N. China, Japan, etc. Winter to Burma.

1946. (1452) **Himantopus himantopus himantopus.** *The Black-winged Stilt.*

Charadrius himantopus *Linn., S. N., i., p.* 151 (1758), (*Europe*).

Breeding S. Europe, S. Asia to China, Ceylon, Malaya, Siam, etc.

1947. (1453) **Recurvirostra avocetta avocetta.** *The Avocet.*

Recurvirostra avocetta *Linn., S. N., i., p.* 151 (1758) (*Europe, Oland*).

Breeding Europe, N. Central Asia, etc. Winter Africa, India, etc.

1948. (1454) **Ibidorhnycha struthersii.** *The Ibis Bill.*

Ibidorhnycha Struthersii, *Vigors, P. Z. S., i., p.* 174 (1831), (*Himalaya*).

Central Asia and Himalayas to W. China.

Sub-family TOTANINÆ.

1949. (1454) **Numenius arquatus arquatus.** *The Curlew.*

Scolopax arquata *Linn., S. N., i., p.* 145 (1758), (*Sweden*).

N. Europe. Winter Southwards, casual in India.

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1950. (1454) **Numenius arquatus lineatus.** *The Eastern Curlew.*

Numenius lineatus *Cuv., Regne d'Ani. i, p.* 521 (1831), (*India*).

Breeding Central Asia, wintering India to Ceylon.

1951. (1455) **Numenius phæopus phæopus.** *The Whimbrel.*

Scolopax phæopus *Linn., S. N., i., p.* 146 (1758) (*Sweden*).

Breeding Europe, N. W. Asia. Wintering India to Ceylon.

1952. (1456) **Limosa limosa limosa** *The Black-tailed Godwit.*

Scolopax limosa *Linn., S. N., i., p.* 147 (1758), (*Sweden*).

Breeding N. Europe and N. W. Asia. Wintering India to Ceylon.

1953. (1457) **Limosa lapponica lapponica.** *The Bar-tailed Godwit.*

Scolopax lapponica *Linn., S. N., i., p.* 147 (1758). (*West Europe*).

Breeding N. Europe, N. W. Asia. Winter N.W. India.

1954. (1458) **Macroramphus semipalmatus.** *The Snipe-billed Godwit.*

Macroramphus semipalmatus (*Jerdon*) *Blyth, J.A.S.B., xvii., I., p.* 252 (1848), (*Calcutta*).

Breeding ?; N. China and Mongolia to Japan. Casual visitor, India and Burma.

1955. (1459) **Terekia cinerea.** *The Terek Sandpiper.*

Scolopax cinerea *Guldenstat, Nov. Com. Petrop., xix., p.* 473 (1774), (*Caspian S.*)

Breeding N. E. Europe, N. Asia. South in winter.

*1956. (1460) **Tringa hypoleuca.** *The Common Sandpiper.*

Tringa hypoleucos *Linn., S. N., i., p.* 149 (1758), (*Sweden*).

Breeding Europe and Asia, England to Japan and Himalayas.

1957. (1461) **Tringa glareola.** *The Wood Sandpiper.*

Tringa glareola *Linn., S.N., i., p.* 149 (1758) (*Sweden*).

Breeding Europe and N. Asia. Winter South, India, Ceylon, etc.

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* The type of the genus *Tringa* is *T. ochropus* (Matthews, Nov. Zool. *xviii*, p. 5, 1911). *Tringa* is therefore the generic name for all the following Sandpipers.

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1958. (1462) **Tringa ochropus.** *The Green Sandpiper.*

Tringa ochropus *Linn., S. N., i., p.* 149 (1758), (*Sweden*).

Breeding N. Europe and Asia. Winter S. to India, Burma, Ceylon, etc.

1959. (1463) **Tringa stagnatilis.** *The Marsh Sandpiper.*

Totanus stagnatilis *Becks., Orn. Taschenb. ii., p.* 292 (1803), (*Holland*).

Breeding Europe and Central Asia. Winter S. to India, Burma and Ceylon, etc.

1960. (1465) **Tringa erythropus.** *The Spotted or Dusky Redshank.*

Scolopax erythropus *Pall., Vroeg's Cat. Coll. Adum., p.* 6 (1764), (*Holland*).

Breeds N. of Arctic Circle Europe and Asia; S. in winter to Ceylon, etc.

*1961. (1464) **Tringa totanus eurhinus.** *The Eastern Redshank.*

Totanus totanus eurhinus *Oberholser, Pro. U. S. Nat. Mus., xxii., p.* 207 (1900), (*Ladak*).

Breeds Central Asia and Himalayas. Winter India, Ceylon, Burma, etc.

1962. (1466) **Tringa nebularia.** *The Greenshank.*

Scolopax nebularia *Gunner., Leem, Beskr. Finm. Lapp., p.* 251 (1767), (*Norway*).

Breeding N. Europe and Asia. S. in winter to Ceylon, etc.

1963. (1467) **Tringa guttifer.** *Armstrong's Sandpiper.*

Totanus guttifer *Nordm., Erm. Reise. Nat. Atl., p.* 17 (1835), (*Ochotsk*).

Breeding N. and Central Asia and Himalayas. Winter to N.-E. India, Burma.

1964. (1468) **Philomachus pugnax.** *The Ruff and Reeve.*

Tringa pugnax *Linn., S. N., i., p.* 148 (1758) (*Sweden*).

Breeds temperate Europe and Asia; S. to India, Ceylon and Burma in winter.

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* It is more than probable that a great number of our Indian migrants are *Tringa totanus totanus* especially in N. W India.

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1965. (1469) **Crocethia alba.** *The Sanderling.*

Crocethia alba *Pall., Vroeg's Cat. Coll., p.* 7 (1766), (*North Holland*).

Cosmopolitan breeder in Arctic Circle. S. to India, Burma, etc., in winter.

1966. (1470) **Eurynorhynchus pygmaeus.** *The Spoon-billed Stint.*

Platalea pygmaea *Linn., S. N., i., p.* 140 (1758), (*Surinam*).

Summer N. E China. Winter China coasts, straggler Burma and N. E. India.

***1967.** (1471) **Erolia minuta.** *The Little Stint.*

Tringa minuta *Leisler, Nacht. Bechs. Nat. Deuts, p.* 74 (1812), (*Hanau*).

Breeds N. E. Europe and Siberia. Winter to India, Ceylon.

1968. (1472) **Erolia ruficollis.** *The Eastern Little Stint.*

Tringa ruficollis *Pall., Reise. Reichs. Russ., iii., p.* 700 (1776), (*Davuria*).

Summer E. Siberia to Japan. Winter S. China, etc., Burma, Bengal, Assam.

1969. (1473) **Erolia subminuta.** *The Long-toed Stint.*

Tringa subminuta *Midden, Reis. N. O. and O. Siber.* (1851), (*Stanaway*).

Breeds E. Siberia. In winter S. Asia to Australia, S. E. India to Ceylon.

1970. (1474) **Erolia temminckii.** *Temminck's Stint.*

Tringa temminckii *Leisler, Nacht. Bechst. Nat. Neut. p.* 63 (1812), (*Hanau*).

Europe, Asia, N. Africa. Winter to India Burma, Ceylon, etc.

1971. (1475) **Erolia acuminata.** *The Asiatic Pectoral Sandpiper.*

Totanus acuminatus *Horsf., Trans. L. S., xiii., p.* 192 (1821), (*Java*).

Breeds N. E. Siberia and Alaska ; winter China etc. (once Gilgit).

1972. (1476) **Erolia ferruginea.** *The Curlew-Stint or Pigmy Sandpiper.*

Tringa ferruginea *Brünnick, Orn. Bor., p.* 53 (1764) (*Iceland*).

Migrant to India and Burma in winter.

* As *Tringa* takes the place of *Totanus* for the Sandpipers, *Erolia* (Vieill., Anal. 1816, p. 55) takes the place of *Tringa* for the Stints.

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1973. (1478) **Erolia alpina pusilla.** *The Eastern Dunlin.*

Scolopax pusilla *Falk., Beyträge, Russ. Reich., iii., p.* 371 (1786), (*Tomsk*).

Breeding W. Siberia, S. to India in winter.

1974. **Calidris canuta canuta.** *The Knot.*

Tringa canutus *Linn., S. N., i., p.* 149 (1758), (*Sweden*).

Breeding N. Siberia, etc. Winter rare straggler into India.

1975. (1477) **Calidris tenuirostris.** *The Eastern Knot.*

Tetanus tenuirostris *Horsf., Trans. L. S., xiii., p.* 192 (1821), (*Java*).

Summer E. Siberia. Winter S. E. Asia, straggler into India and Burma.

1976. (1479) **Limicola falcinella falcinella.** *The Western Broad-billed Sandpiper.*

Scolopax falcinellus *Pontop., Danske Atl., i., p.* 263 (1763), (*Denmark*).

Breeding N. Europe and N. W. Asia; winter to N. W. India.

1977. (1479) **Limicola falcinella sibirica.** *The Eastern Broad-billed Sandpiper.*

Limicola sibirica *Dresser, P. Z. S.*, 1876, *p.* 674 (*China*).

Breeding N. E. Siberia. Winter South to N. E. India, Burma, etc.

***1978.** (1480) **Lobipes lobatus.** *The Red-necked Phalarope.*

Tringa lobata *Linn., S. N., i., p.* 148 (1758), (*Hudson's Bay*).

Breeding N. Europe, Asia and America. Winter S. to India, etc.

1979. (1481) **Phalaropus fulicarius.** *The Grey Phalarope.*

Tringa fulicaria *Linn., S. N., i., p.* 148 (1758), (*Hudson's Bay*).

Breeding circumpolar. S. in Asia to N. India, etc.

Sub-family SCOLOPACINÆ.

1980. (1482) **Scolopax rusticola rusticola.** *The Wood-Cock.*

Scolopax rusticola *Linn., S. N., i., p.* 146 (1758), (*Sweden*).

Breeding N. Europe and Asia. Wintering South to Ceylon, etc.

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* The Red-necked Phalarope and Grey Phalarope through so alike superficially are very distinct generically and cannot be retained in the same genus.

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1981. (1483) **Gallinago nemoricola.** *The Wood-Snipe.*

Gallinago nemoricola *Hodgs., J. A. S. B., vi., p.* 490 (1831), (*Nepal*).

Himalayas, Dalhousiæ to E. Assam, Burma, Bombay.

1982. (1486) **Gallinago solitaria.** *The Solitary Snipe.*

Gallinago solitaria *Hodgs., Glean. in Sci., iii., p.* 288 (1831), (*Nepal*).

Altai to Japan, Himalayas and N. Burmese Hills; S. in winter.

1983. (1485) **Gallinago gallinago gallinago.** *The Common Fantail Snipe.*

Scolopax gallinago *Linn., S. N., i., p.* 244 (1758), (*Sweden*).

Europe and N. Asia to Lake Baikal, S. whole Indian Empire.

1984. (1484) **Gallinago gallinago raddei.** *The Eastern Fantail Snipe.*

Scolopax gallinago raddei *Buturlin, Waders. Russ. Em. p.* 56 (1902), (*E. Siberia*).

Eastern Siberia and N. China. Winter to S. China, Burma, E. India, etc.

1985. (1485) **Gallinago stenura.** *The Pin-tail Snipe.*

Scolopax stenura *Kuhl, Bonap., Ann. Stor. Nat. Bol. iv., p.* 335 (1830), (*Sunda Is.*).

Summer N. E. Asia. Winter S. including whole Indian Empire.

1986. **Gallinago media.** *The Great Snipe.*

Scolopax media *Lath., Gen. Syn. Supp. i., p.* 292 (1787), (*England*).

Breeding N. Europe to Caucasus. Straggler into India.

1987. **Gallinago megala.** *Swinhoe's Snipe.*

Gallinago megala *Swinh., Ibis,* 1861, *p.* 343 (*Peking*)

Breeding N. E. Siberia and China. Winter South. Straggler into India and Burma.

1988. (1487) **Lymnocryptes minima.** *The Jack Snipe.*

Scolopax minima *Brünn., Orn., Bor. p.* 49 (1764), (*Europe*).

Breeding N. E. Europe and N. W. Asia. Winter South, whole Indian Empire.

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Family ROSTRATULIDÆ.

1989.* (1488) **Rostratula benghalensis benghalensis.** *The Painted Snipe.*

Rallus benghalensis *Linn., S. N., i., p.* 153 (1758), (*Asia*).

N. E. Africa, S. Arabia, Persia, India, Ceylon, Burma, China, etc.

Order GAVIÆ.

Family LARIDÆ.

Sub-family *Larinæ.*

1990. (1489) **Larus ichthyaetus** *The Great Black-headed Gull.*

Larus ichthyaetus *Pall., Reise. Reichs. Russ., ii.*, p. 713 (1733), (*Caspian Sea*).

Breeding S. Russia to Iritisch. Winter India, Burma and Ceylon.

1991. (1490) **Larus ridibundus ridibundus.** *The Black-headed Gull.*

Larus ridibundus *Linn., S. N., p.* 225 (1736), (*Europe*).

Breeding Europe to Turkestan. Winter N. India to Bombay, etc.

1992. (1491) **Larus brunnicephalus.** *The Brown-headed Gull.*

Larus brunnicephalus *Jerd., Madr. J.L.S., xii., p.* 225 (1840), (*India*).

Breeding Central Asia. S. in winter, India, Burma, Siam, etc.

1993. (1492) **Larus hemprichii.** *The Sooty Gull.*

Adelarus hemprichii *Brüch. J. F. Orn.* 1853, *p.* 106 (*Red Sea*).

Coast of East Africa, Red Sea, S. Arabia, Mekran and Sind Coasts.

1994. (1493) **Larus genei.** *The Slender-billed Gull.*

Larus genei *Breme, Rev. Zool.*, 1839, *pt. ii., p.* 321 (*Africa*).

Mediterranean to Persian Gulf, Mekran, Sind.

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* This genus has little in common with the true Snipes and will have to be removed to a position leading from the Rails to the Snipe and their other relations.

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1995. (1494) **Larus fuscus taimyrensis.** *The Dark-backed Herring Gull.*

Larus affinis taimyrensis *Buturlin, Mess. Orn.* 1911, *p.* 149 (*Yenessei*).

Breeding N. Europe and Siberia. Winter S. to E. Indian Coasts.

1996. (1495) **Larus argentatus cachinans.** *The Yellow-legged Herring Gull.*

Larus cachinans *Pall., Zoog. Russ. As., ii., p.* 318 (1827), (*Caspian Sea*).

S. Europe, N. Africa, S. W. Asia, E. to Bay of Bengal.

Sub-family STERNINÆ.

1997. (1496) **Chlidonias leucopareia indica.** *The Indian Whiskered Tern.*

Viralva indica *Stevens, Shaw's Gen. Zool., xiii., i., p.* 169 (1832), (*Cawnpore*).

All India to Ceylon.

1998. (1497) **Chlidonias leucoptera.** *The White-winged Black Tern.*

Sterna leucoptera *Temm., Man. d'Orn., p.* 483 (1815) (*Mediterranean*).

S. Europe to E. Asia. Tippera, Burma and Ceylon, etc.

1999. (1498) **Hydroprogne caspia caspia.** *The Caspian Tern.*

Sterna caspia *Pall., Nov. Com. Acad. Petro., xiv., i., p.* 582 (1770), (*Caspian Sea*).

In India breeding N. W. Coast and Ceylon.

2000. (1499) **Sterna nilotica nilotica.** *The Gull-billed Tern.*

Sterna nilotica *Gmel., S.N., i., p.* 606 (1789), (*Egypt*). Europe, N. Africa, Central Asia, India and Ceylon.

2001. (1500) **Sterna sandvicensis sandvicensis.** *The Sandwich Tern.*

Sterna sandvicensis *Lath., Gen. Syn. Suppl., i., p.* 296 (1787), (*Sandwich Island*).

Summer in Europe; winter S. to Africa, Persian Gulf and N. W. India.

2002. (1501) **Sterna bengalensis bengalensis.** *The Smaller Crested Tern.*

Sterna bengalensis *Less., Traite d'Orn., p.* 621 (1831), (*Indian Coasts.*)

Mediterranean to Persian Gulf and N. W. India.

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2003. (1501) **Sterna bengalensis zimmermanni.** *The Chinese Small Crested Tern.*

Sterna zimmermanni *Reichen., Orn. Monatsbr., p.* 82 (1903), (*Kiachao*).

East Coast China. ? Siam and Burma.

2004. (1502) **Sterna bergii velox.** *The Arabian Large Crested Tern.*

Sterna velox *Cretzschmar, Ruppell's Atl., p.* 21 (1826), (*Coasts of Red Sea.*)

Red Sea to Persian Gulf and Ceylon.

2005. (1502) **Sterna bergii cristata.** *The Australian Large Crested Tern.*

Sterna cristata *Stephens in Shaw's Genn. Zool., xiii., p.* 146 (1826), (*China*).

Australia, S. E. China to Malay Pen., Siam and Burma.

2006. (1503) **Sterna seena.** *The Indian River Tern.*

Sterna seena *Sykes, P.Z.S.*, 1832, *p.* 171 (*Deccan*).

India, Burma and N. Malay Pen.

2007. (1504) **Sterna melanogaster.** *The Black-bellied Tern.*

Sterna melanogaster *Temm., Pl. Col., pl.* 434 (1827) (*Ceylon*).

All India and Burma. Ceylon.

2008. (1505) **Sterna repressa.** *The White-cheeked Tern.*

Sterna repressa *Hartert, Nov. Zool.*, 1916, *p.* 288 (*Persian Sea*).

Sea coasts from E. Arabia and Persia to Laccadives.

2009. (1506) **Sterna hirundo hirundo.** *The Common Tern.*

Sterna hirundo *Linn. S.N., i. p.* 137 (1758), (*Sweden*

Temperate N. America, Europe, Asia. India to Ceylon.

2010. (1506) **Sterna hirundo tibetana.** *The Tibetan Tern.*

Sterna tibetana *Saunders, P.Z.S.*, 1876, *p.* 649 (*Tibet*)

Tibet, Turkestan, Himalayas.

2011. (1507) **Sterna longipennis.** *Nordmann's Tern.*

Sterna longipennis *Nordm., in Erman's Reise., p.* 17 (1835), (*Ochotsk*).

Eastern coasts of Asia to New Guinea, Malay Pen., Ceylon (once).

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2012. (1508) **Sterna dougalli korustes.** *The Eastern Rosy Tern.*

Sterna korustes *Hume., S.F., ii., p.* 318 (1874), (*Andamans*).

Ceylon, Andamans, Tenasserim Islands, etc.

2013. (1510) **Sterna albifrons albifrons.** *The Little Tern.*

Sterna albifrons *Pall., Vræg's Cat., p.* 6 (1764), (*Holland*).

Temperate Europe, Central Asia. Winter, N. W. India, (sea-coasts).

2014. (1510) **Sterna albifrons gouldi.** *Hume's Little Tern.*

Sterna gouldi *Hume, S.F., v., p.* 326 (1877), (*Upper India*).

Breeding on the larger rivers of N. India; extreme W. to E.

2015. (1509) **Sterna albifrons sinensis.** *The White-shafted Little Tern.*

Sterna sinensis *Gmel., S. N. i., p.* 605 (1789), (*China*).

Ceylon, Burmese and Malayan coast eastwards (sea coasts).

***2016.** (1511) **Sterna albifrons saundersi.** *The Black-shafted Little Tern.*

Sterna saundersi *Hume, S.F., v., p.* 324-326 (1877), (*Karachi*).

Resident, breeding, on coasts of Sind and Mekran.

2017. (1512) **Sterna sumatrana.** *The Black-naped Tern.*

Sterna sumatrana *Raffl., Trans. L.S., xiii., p.* 329 (1877), (*Sumatra*).

Islands of Indian Ocean, Malay Pen. to Australia, etc.

2018. (1513) **Sterna anætheta anætheta.** *The Panayan Tern.*

Sterna anæthetus *Scop., Del. Flor. et Faun. Insubr., ii., p.* 92 (1786), (*Panay*).

Japan to Ceylon.

2019. (1513) **Sterna anætheta fuligula.** *The Red Sea Brown-winged Tern.*

Sterna fuligula *Licht., Forster's Descrip. Anim.* (1844), (*Red Sea*).

Red Sea. Mekran Coast to islands off Malabar.

* This bird is possibly a true species and not a subspecies but for the present I retain it as a race of *albifrons* (*minuta* auct.)

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2020. (1514) **Sterna fuscata infuscata.** *The Indian Sooty Tern.*

Sterna infuscata *Licht. Verv. Doubl. Mus. Berlin, p.* 81 (1823), (*India*).

Laccadives, India, Malay Archipelago, etc.

2021. (1515) **Anous stolidus pileatus.** *The Philippine Noddy.*

Sterna pileata *Scop., Del. Flor. et Faun. Insubr. ii, p.* 92 (1786), (*Philippines*).

Japanese Islands, Philippines to Laccadives, to Nicobars, etc.

2022. (1516) **Anous tenuirostris.** *The Slender-billed Noddy.*

Sterna tenuirostris *Temm., Pl. Col. d'Ois., ii., pl.* 202 (1873), (*Senegal errore, Seychelles*).

Tropical Seas.

2023. **Gygis alba.** *The White Tern.*

Sterna alba *Sparm., Mus. Carl., i., No.* 2 (1786), (*India orientali errore, Ascension I.*).

Straggler Bay of Bengal.

2024. (1517) **Rhyncops albicollis.** *The Indian Skimmer.*

Rhyncops albicollis *Swains., An. in Menag., p.* 360 (1838), (*India*).

India, Burma, Siam.

Family STERCORARIIDÆ.

2025. (1518) **Stercorarius parasiticus parasiticus.** *Richardson's Skua.*

Larus parasiticus *Linn., S. N., i., p.* 136 (1758), (*Scandinavian Coast*).

Breeding almost circumpolar. Mekran and Sind Coasts.

2026. (1519) **Stercorarius pomarinus.** *The Pomatorhine Skua.*

Lestris pomarinus *Temm., Man. d'Orn., p.* 514 (1815), (*Holland*).

Moulmein, once.

(*To be continued.*)

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GAME ANIMALS OF KASHMIR AND ADJACENT HILL PROVINCES.

By

Col. A. E. Ward.

Part IV.

(With a map, plate and one text block.)

GOAT ANTELOPES.

No. 352.—SEROW.

The "Ramu" of Kashmiris; eastward named "Yahmu" and then further the "Kurt" or even the "Thar" is the name used by the villagers.

A few years ago very few serow were to be found in Kashmir, as they had been nearly exterminated by the villagers who, when the snow was deep, drove them with dogs.

When disturbed the serow dashes wildly down hill, leaping from rock to rock with extraordinary agility, which is unlooked for in a heavy built animal; it is this habit which gives the dogs a great advantage, for it gets driven down to the bottom of the valley and is mobbed in the soft snow. Apart from the snow the serow is not a good traveller on the flat, where it seldom goes, for its home is amongst rocks and forest, where the undergrowth is not heavy. At times however it will penetrate into masses of ringal and hide.

After a rainy night comes often a sunny morning, the serow then takes to some rocky ledge and lies in the sunshine, often alone but generally within reasonable distance of a companion. In country which is not disturbed and is well preserved, a pair of serow will settle down in a small area, and apparently seldom leave it. In the Kashmir Game Reserves it is easy to find a serow, but not always so easy to get at it. Two settled down amongst some cliffs which bordered the road or rather the riding path, for in the Kashmir Game Reserves there are no public roads. Over and over again these serow were seen, sometimes they would stand but if within 200 or 300 yards they would move off.

Last year these serow were over bold and were wiped out by a guest of the State, but their place has been taken by others, enticed possibly by the shelter of the overhanging rocks, the trickling water, the feeding and comparative seclusion.

Measurement of Horns.

Length.	Girth.	Tip to Tip.	Name of Sportsman.	Date.	Remarks.
9¾″	4½″	Left horn broken.	C. E. Grenville Gough.	1920	
9½″	5½″	4¼″	K. C. Tarzetzhy ..	1905	Erin, Kashmir.
9″	5″	..	A. E. Ward ..	1911	Kashmir.
8¾″	..	..	Capt. Stockley ..	1911	Kistwar. (Owner's measurement.)
8¾″	5⅛″	4⅝″	A. Lathinson ..	1914	Sind Valley.
8¾″	..	..	R. S. L. Fowler ..	1913	Padar ,,
8½″	..	..	F. H. Hornsby ..	1913	Kistwar.
8½″	..	..	R. N. Rashleigh ..	1913	Akahal, Sind.

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These horns are a poor record, but Kashmir and the adjacent districts do not supply any better. It may be that the serow are overshot and do not reach old age, for many sportsmen want a specimen to complete a collection. In the United Provinces horns of 10 inches are not rare. 12″ is a really good head but this length has been exceeded.

A frightened serow utters a screeching whistle, which when once started it will continue for some time.

On a winter's day in one of the Game Reserves this noise was repeated over and over again. The verandah of the very rough shed in which residence had been taken up looked over the river and across an open flat space about 150 yards wide, then came a path following the line of the hills on the opposite side of the river. The serow was somewhere on the flat and upstream.

It was a bright sunny day, and, as the snow was slowly melting, walking was not easy as the surface would not bear but gave way with a jerk.

Going round by the bridge and walking up stream along the path, which as mentioned skirted the opposite hill, took about half an hour. The path turned to the right and went round a few rocks which jutted out; beyond this corner nothing could be seen except the bushes on the flat covered with snow, forming a number of pure white mounds.

The path as usual was marked with deer tracks, but there was nothing to guide or to give a clue as to what animal had frightened the serow; probably a leopard was on the prowl, but it might be that pigs were about.

In order to see round the rocky corner an attempt to get off the path to the left was made, but the bushes and snow made bad going; the serow stopped whistling by the time the corner was turned, it was standing in the open on the flat, and the track of its move from the hills was plain. On the road opposite the serow were the marks of a leopard, also the sign in the snow where it had crouched and watched. When disturbed it had moved up the valley from there it crossed the river by a bridge up stream of the hut and went into the hills. Unless accompanied by trained dogs it is not good enough to follow a leopard up hill in heavy snow, of this more will be written hereafter

The serow was in luck for the leopard would in all probability have killed it when it went back to the hill side.

The spring was at hand, and soon the migrating finches would arrive, the little anemones and the tulips would be in flower. The leopards would lose their advantage over the deer and serow, and most animal life would rejoice there had been a very severe winter and heavy snow falls. The reports of kills by leopards were very numerous, seventeen deer having been accounted for in Achhabal Rukh alone! It was vexatious to have been done by the 'pard,' but probably the serow was saved.

The difficulty in getting a shot at a serow is due to the ground it frequents. Standing absolutely still it is difficult to see amongst the trees and rocks; probably it is concealed and is watching the sportsman, then suddenly it dashes off and is gone in a second.

If found on bare rock the serow is in an almost inaccessible spot where it has for some reason or other taken refuge, and is then much on the alert. When serow are plentiful sooner or later the sportsman after topping the crest of a ridge will get an easy shot. There is no rule which governs serow shooting, all that can be done is to make the best of the chance when it comes.

No. 354.—GORAL.

THE PIJUR OF KASHMIR.

Not being concerned with the scientific side of sport and wild animals at present, let us adhere to Jerdon's classification and class the serow with goral, leaving discussion to the future.

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The Goral has a wide distribution, it inhabits any suitable ground from 2,000′ to about 8,000′ or higher, but it is not found in the hills, from which in winter it cannot descend below the snow line. It has been shot in the Sind, Kashmir, but probably had crossed the valley from the Baramulla hills. On the Murree road route into Kashmir, Kishtwar and Jammu there are goral which seem to carry fine heads.

In former notes on sport mention was made of an 8½ inch goral head, and this was the longest seen out of many scores. Mr. P. F. Hadow now tops the list with 8⅝″ measured, it is believed, by Rowland Ward who was most exact.

MEASUREMENT OF HORNS.

Length.	Girth.	Tip to Tip.	Name of Sportsman.	Date.	Remarks.
8⅝″	3¾″	1½″	P. F. Hadow ..	1908	
8½″	3½″	4	H. W. Anderson ..	1914	Kishtwar.
8½″	..	..	R. Fernie	1918	Owner's measurement.
8 5/16″	3¼″	1 Tip broken	Col. S.D. Turnbull	1904	
8″	3½″	3½″	Sir Boyce Combe ..	1904	
8 ″	..	..	C. Crea.	1908	Owner's measurement.
8 1/16″	..	..	Col. Turnbull ..	1904 or 05	,, ,,
8″	..	..	Capt. Ramsbottam	1911	
8″	3½″	2⅓″	H. R. Pownall ..	1911	
8″	..	..	R. Fernie.	1918	Owner's measurement.
8″	..	..	Capt. Travers ..	1921	,, ,,

Goral are to be found near most hill stations, and afford first class sport to those who care for a change from files and office routine, not to mention "social functions."

A small bore rifle and "a week end" of leisure with a climb over the hills bring health and a sense of freedom from the "prison" feeling of secretarial duties.

The lower ranges, especially the Siwaliks, are full of goral. They are not strictly speaking gregarious, but on the same hill-side several are often found.

An Indian friend, a first class sportsman and shot, owned a Goral Reserve which once a year was driven. Opposite to the cliffs was a bush covered hill-side where the guns were placed. Along the cliffs the goral came, some times one by one then two or three, at distances of about 120 to 200 yards from the guns. How the little goat-like creatures hopped about, and how they were missed!

Now and again one would stand still and met its fate, but to kill more than two or three was the exception.

Sitting on a flat rock with bushes on all sides, and intently watching the goral notice was taken of nothing else, until a bear's growl was heard absolutely

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THE TIBETAN GAZELLE.

GORAL.

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within a few feet, then a loud explosion, and the bear fell back. An old shikari "Gunga" had slain the bear with the 12 bore gun whilst it was almost on us. Gunga afterwards explained that he had seen the bear coming along the very narrow path which led to the post and had put ball into the gun; then the bear's head reached the rock and no time was to be spared. The bear probably was quite peaceful and only wanted to get away from the noise, and finding the track in the bushes had come along it.

Those goral drives were pleasant days but the old friend is gone and his son reigneth in his stead.

On a different occasion the afternoon was far advanced, a goral had been shot and despatched to the Camp, which was pitched about two miles away in an open glade amongst the outside hills which border on the plain, when another goral was seen, not in the valley where the first was shot but on a hill further from the road. There was no difficulty in getting at it nor in wounding it, but an hour or so was lost in following up and finally killing it. Then the light failed, there was nothing for it but to make a bee line for the plain, for the valley in which the road and camp lay could only be reached by climbing over a very difficult ridge, and this was not to be thought of in the dark.

The small ravine down which the return had to be made was bound to reach the fireline at the foot of the hills, and once on the broad line, the rest was easy.

The distance could not have been more than 2½ miles, but it was midnight before Camp was reached. There were no waterfalls, the bed of the little stream in daylight would have presented no obstacles, but at night every yard ahead had to be prodded with a stick. In high grass close to the fireline a wild beast of some kind or other growled and caused the coolies to drop the goral and bolt. Nothing would induce them to go back. Curious people, they had managed to get along very well carrying the goral with apparent ease, and all the time probably thinking why on earth the track was found so difficult and why everyone could not see as well as they could, and yet the growl was too much for them and they lost their goral, for by morning it had been eaten by jackals.

No. 355.—THE NILGAI ANTELOPE.

The blue bull is held sacred in Jammu and many can be seen from the Railway carriage on the journey from Sialkot to Tawi Station. There are now practically no other animals in the Jammu Game Reserves, and as the damage done by Nilgai in the crops is great it must be intensely aggravating to have to try and raise your food in fields alongside of herds of Nilgai which are protected. In Kumaon it was bad enough, for the Nilgai are wonderful jumpers and used to clear a 6 foot high fence with ease. However by shooting them down as opportunity occurred, male, female and young, the numbers were kept in check. It was understood that anyone who got leave to shoot in the jungles should help to diminish the number of this destructive Antelope in the Kumaon Forests.

The meat of an old Blue Bull is very tough. Even the Mahouts do not care much about it, but they are very keen on getting the skins both for leather and also for selling as gigantic mussacks. These mussacks or inflated skins are used for carrying rafts, and stand a great deal of bumping against rocks, which they certainly get in many of the rapids when the main rivers leave the hills.

As the Nilgai is a heavily made animal of nearly 14 hands in height, attempts are made in some places to tame them for draught, and they are generally used with a bullock as one of the pair. Not much success has attended this experiment.

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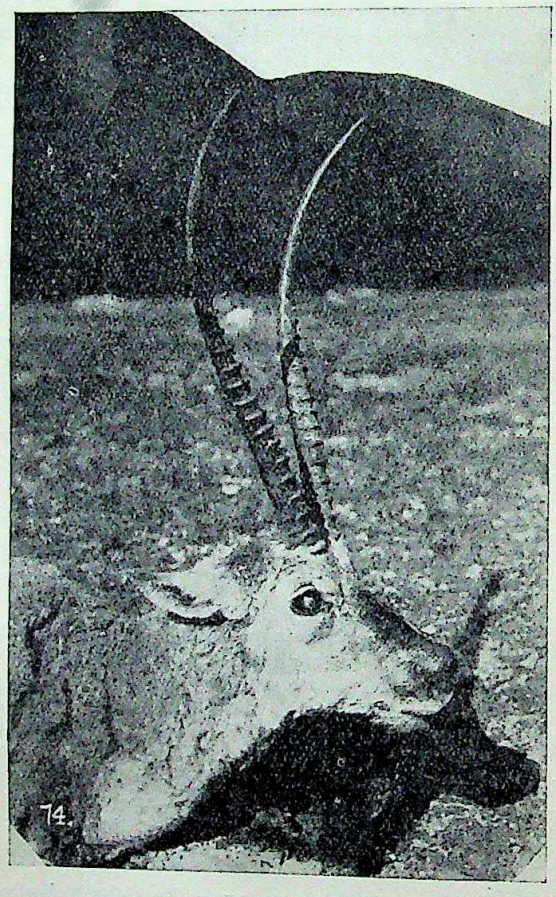
No. 357.—THE BLACK BUCK.

There is no necessity to dwell on the "Black Buck" in sporting articles dealing with the game of the hills. It need hardly be said that what few there may be are in the plains country of Jammu where visitors may not travel.

No. 358.—THE TIBETAN ANTELOPE.

THE "HERAN" OF KASHMIRIS, THE "CHERU" OR "CHOOS" OF LADAKIS.



Head of Tibetan Antelope.

This antelope is found only at very high altitudes from about 14,500, to the tops of the highest hills. Probably at these very great altitudes the herd is migrating. In the spring the sexes separate, only the very young males remain with the females and later on in the year females are seen alone. On the Karakoram, hundreds of does may be noticed in the summer, all intent on migration.

It is difficult to give any tolerably exact dates on which this antelope can be found at any particular place or elevation, because the seasons in Northern

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Ladak and Tibet vary greatly, and all depends on the severity or the mildness of the early spring and in consequence the grazing.

After searching the Changchenmo for a shootable buck a move was made across the passes when many big horned males were seen. On another occasion, very little later in the year, Changchenmo was full of bucks.

Now and again a solitary male may be seen. No. 2 on the list was alone and not another antelope was found in the ravine, but, as a rule, they are gregarious whether in their summer grazing grounds or when journeying from place to place.

The list of horns is not encouraging. It may be that the Tibetan Antelope has taken to other localities but possibly sportsmen have not reported their successes, and the horns have not been put on record.

MEASUREMENT OF HORNS.

Index No.	Measurement.			Name of Sport man.	Date.	Locality, &c.
	Length	Girth.	Tip to Tip.			
1	27½″	5¾″	13½″	P. F. Hadow ..	1903	
2	26½″	5½″	..	A. E. Ward ..	..	Kyam. Changchenmo.
3	26″	5¼″	..	A. E. Ward ..	..	Little Tibet.
4	26″	5½″	14″	K. S. Fitze ..	1916..	Ladak.
5	25½″	5½″	13″	Miss Barber ..	1908	
6	25″	5″	15″	Capt. Bruce ..	1908	
7	25″	..	..	J. V. Allan ..	..	Gogra, Ladak.

The record horns were in the Hume Collection, they measured fully 28 inches shortly after being killed, but were measured at home at 27¼″. All horny sheaths shrink when drying up, the shrinkage being from the end next to the skull.

Occasionally on broken ground a close shot can be obtained, but as a rule the bucks stay out on a sandy plain or on a bare hill side. Crawling along sand and pebbles is ruinous to one's woollen clothing, and this is a serious trouble when baggage has been cut down to a minimum. After about a week one of the two warm suits taken beyond Leh was in tatters.

The time of the year was late in May and very early in June. Having during May been lucky with the wild sheep, it was time to have a turn at the antelope.

ABSTRACT FROM "DIARY."

May 28th.—Tried for hours to get near two very fine bucks, but, it was useless.

Then came on six, and again on four but the country was far too open.

May 29th.—Again saw six ; very possibly the same lot, the nearest cover was quite 300 yards from the bucks ; shelter was taken there and as time went on a single antelope strolled towards the cover, then suddenly wheeled round and bolted taking of course the others with him : it was no use firing.

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The camp was moving, so waited until it arrived and then towards evening tried fresh ground ahead. Four bucks were lying down in the sand having scooped out small hollows, as is their habit, consequently they did not show up well and were nearly overlooked. There was no chance of getting nearer than a short 200 yards so when the bucks rose the shot was taken and one hit, this was followed and come on whilst lying down, again he was wounded and at last found dead. The diary adds "saw a hawk and two pigeons, the first birds of the season." May and early June are too soon in the year for migratory birds in little Tibet.

May 30th.—Had a long stalk and missed a hard shot at an antelope.

June 1st.—The camp was high up in a side ravine, where stalking was easy, the antelope were in small bands and not very wild. In the morning got an easy shot under 200 yards and killed, then got another at about 100 yards, and again had commenced a third advance when a herd of 25 cow yaks were seen and the afternoon was spent in watching them. There was no bull but that did not matter for yak were not wanted. Light snow fell and gave an excuse for a rest on the next day.

June 3rd.—Got close up to antelope and killed to the first barrel, and wounded another with the second, which was easily bagged. Then had shortly after an easy shot, but missed badly, or rather only slightly wounded it, this buck joined others in a herd about a mile or so further up the ravine ; killed out of that lot a buck which gave an easy shot, and missed the wounded animal.

On the way back to camp had a long shot at a running buck which fell dead. That made the fourth in one day. The antelope must have been migrating for on the following day only one solitary animal was seen.

For some days afterwards the hill sides were devoid of any life except for a large black wolf, but its pursuit is another story.

Since the above records were entered in the Diary, only one buck was shot, and the readers of this article may say "a very good thing too."

There were any number of antelope about ; where are they now to be found is the question ? They can scarcely have been killed off, wolves undoubtedly take many, but wolves, owing to the prices paid for the pelts, are decreased in numbers. There can be little doubt that high up in the Gogra and towards the Demjor lake the Tibetan antelope still is plentiful. The limited number shot can have had little effect on the vast herds that existed. The country has no inhabitants to kill these antelope, success seems to depend entirely on the chance of meeting the *cheru* whilst migrating.

THE GAZELLES.

The Gazelles which are found in Central Asia have in the "Fauna of India" been divided up into three species.

It is not easy to agree to the distribution of the Persian Gazelle, and the "larger species from parts of Mongolia" when the notes of various travellers are studied.

According to Blanford we have (1) The Tibetan Gazelle ; (2) *Gazella subgutturosa* or the Persian Gazelle : (3) *Gazella gutturosa*.

If No. 3 can be separated from the Persian Gazelle, it might be convenient to call it the Mongolian Gazelle, but Mongolia also harbours other Gazelles ; this is discussed in the next chapter.

No. 361.—THE TIBETAN GAZELLE.—THE "GOA" OF TIBET.

In the early eighties, that is from about 1880 to 1885, a large number of these Gazelles were killed. Apparently they were never numerous even in their stronghold, which is in Northern Ladak on the plateaux, notably in Rupshu and Hanle, and by the Kyun Fresh and Salt Lakes. There in 1882 ten bucks were shot by sportsmen in 5 days.

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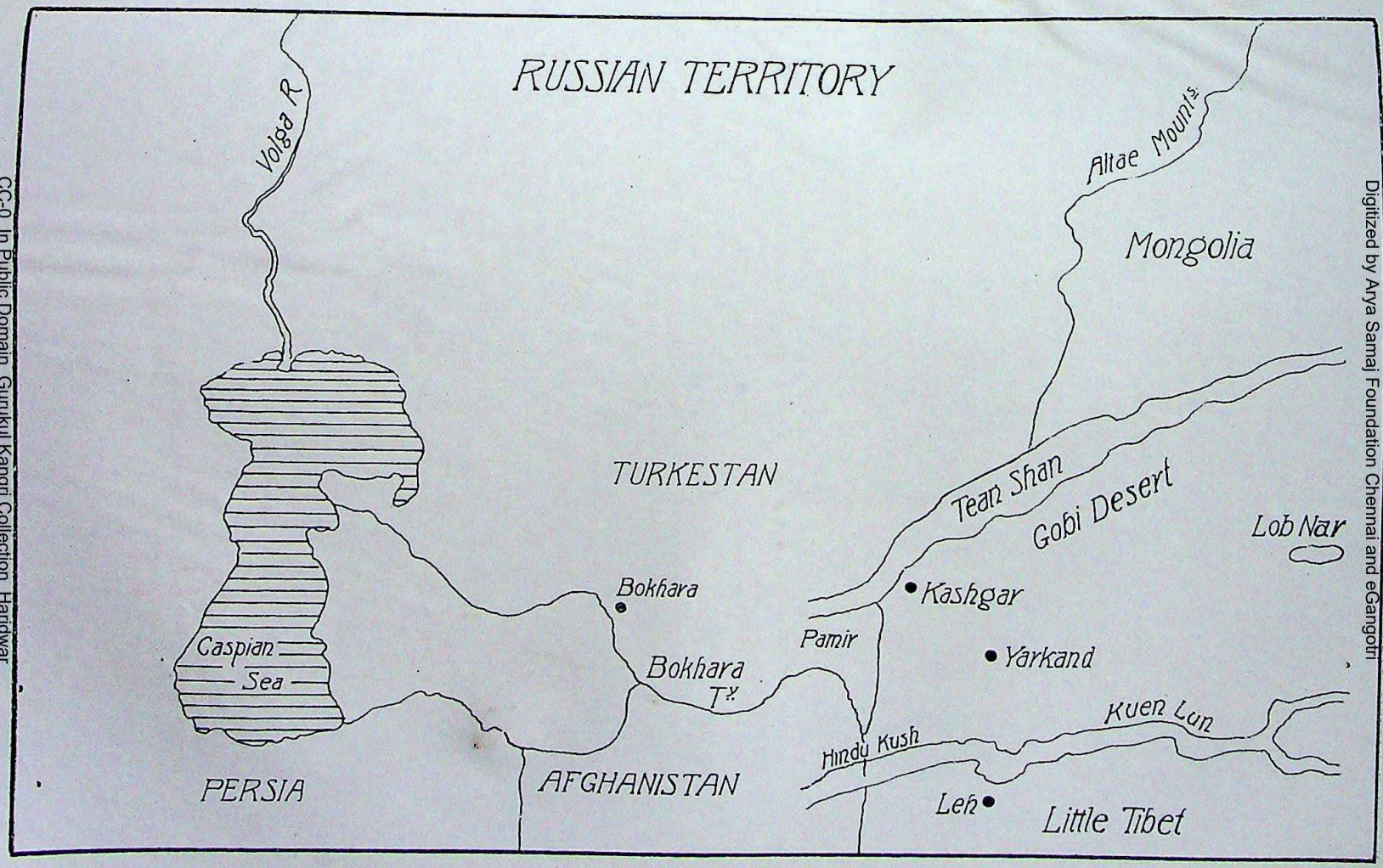
Journ., Bombay Nat. Hist. Soc.



HAUNTS OF THE CENTRAL ASIAN GAZELLES.

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The Goa is found in small herds rarely exceeding 8 or 10 in number. Long ago when Kinloch, who is quoted by Blanford, was in Ladak the game was not as shy as at present, and perhaps this gazelle was less so than most other animals, but that it is indifferent to the scent of man or to their enemies, the wolves, &c., is scarcely the case.

Near the Nima crossing of the Indus, a small batch of Goa were lying on the plain just out of shot from the broken and higher grounds. From above was a good view of a ravine along which an easy approach could have been made but it was to windward of the game. After a long wait, the gazelles got up, and without waiting to look round dashed across the plain. From where they were they could not have seen into the small ravine but the glasses showed a wolf, the scent evidently caused the sudden departure.

Other Goa were found a short while afterwards, but the wind was uncertain and the result a failure owing to this mishap. It was some time before any luck came off.

The Ladaki Shikaris would insist that antelope also did not mind an approach down wind so on two occasions, to test this, trials were made and on both the animals bolted.

Ludlow sent notes on the Goa to the journal and also a photograph of the $14\frac{1}{8}$″ trophy secured, hence there is no need to write more.

The record of a few other horns is attached and a photograph of No. 6 showing the complete animal is furnished.

MEASUREMENTS OF HORNS.

Index No.	Length.	Girth.	Tip to Tip.	Name of Sportsman	Date.	Locality, &c.
1	$14\frac{1}{8}$″	$3\frac{3}{4}$″	$3\frac{3}{4}$″	F. Ludlow ..	1919	Ladak
2	$13\frac{3}{4}$″	$3\frac{1}{4}$″	5″	Capt. R.W. Bruce	1911	,,
3	$13\frac{3}{4}$″	$3\frac{3}{4}$″	3″	Capt. G.F.Mockler	1905	,,
4	$13\frac{1}{2}$″	..	6″	Capt. Frees ..	1914	,,
5	13″	3″	4″	F.W.A. Wells ..	1905	,,
6	13″	..	..	Capt. I.G. Allan	..	,,

In Rowland Ward's records, there is another head carrying $14\frac{1}{8}$ inch horns owned by The Hon'ble Walter Rothschild.

Goa do not appear to visit the Kuen-lun; during two journeys in that country none were seen, there were hundreds of antelopes but no gazelles of any species. If this surmise is correct, it may help to elucidate matters when dealing with the rather vexed question of the distribution of the other Gazelles which are found in Turkistan, Mongolia and countries more or less adjacent to the Ladak boundaries.

THE GUTTUROSA GAZELLE—THE DJERAN OF KASHGAR.

The Hwang Yang or Yellow Goat of the Chinese.

Blanford in his concluding sentence when describing the Persian Gazelle mentions this Gazelle.

It is a far taller animal than the Goa, but is slighter built and paler in colour

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The late Mr. Ney Elias, a well-known explorer and traveller, gives this Gazelle an enormous distribution "Eastern Mongolia, all over Western Mongolia from the northern bend of the Yellow River to the Altai mountains they were generally in large herds sometimes I should think four or five hundred or more together." Elias measured a buck as 27½" at the shoulder, he also took home a pair of horns to Blyth who called the animal "*A gutturosa* sub-genus *Procapra*." This head was got near the Gobi. Colonel Biddulph shot one on the road between Macallashi and Kashgar. Major Cumberland, Messrs. J. V. Phelps and E. L. Phelps also got their specimens in Turkestan. Blyth described the horns thus :—"resembles the Common Indian Gazelle except that the horns are longer and curve outwards, the tips being turned sharply inwards towards another."

Look at the sketch map of the country under discussion, and remember that from the Kuen-lun to the Altai is 1,000 miles in a straight line to the Northwards, and to the Caspian considerably more to the Westward, there is ample room for local differences in the Gazelles, or in other words *sub-gutturosa* which could conveniently be called *sub-gutturosa* and it is probably here that the Persian and Przewalskii's Gazelles come in.

No. 360.—THE PERSIAN GAZELLE.

The only portion of British territory where this animal had been shot, as Sir Oliver St. John remarked, is near Pishin. He shot one here and thus brought it to notice, then others were obtained.

This Gazelle is very rare in Baluchistan but not so towards Kandahar and in Afghanistan.

That this sub-species "extends through Turkestan to the Gobi" is very doubtful for that is the home of the Djeran.

There is considerable difficulty in separating the varieties of the Central Asian Gazelles. In the future articles to be written for the Society it will probably be best to omit as being beyond our range.

1. Przewalskii's Gazelle.
2. Persian species as belonging to Afghanistan and Persia.

and deal only with

1. The Tibetan Gazelle (Goa).
2. The Gutturosa of Turkestan and Mongolia.
3. The so called Goitered Gazelle from the Altai.

In order to make the notes on these Gazelles as clear as possible Col. Harry Ward has been asked to have photographs taken of the horns at home.

(*To be continued.*)

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NEW AND LITTLE KNOWN INDIAN BOMBYLIIDÆ.

By Lieut.-Colonel C. G. Nurse.

(*Continued from page* 641 *of this volume.*)

Part II.

When I began my studies of this family, I hoped to deal with the Indian representatives of all the genera as fully as I have dealt with those belonging to the two genera, *Litorrhynchus* and *Exoprosopa*, included in my former paper. But unforeseen circumstances have necessitated my removal from London, and I have no longer the opportunity of consulting the library at the British Museum, or of access to the specimens in the national collection. In the present paper, therefore, I confine myself to material I had prepared before leaving London, but as it brings forward representatives of several genera not previously recorded from Indian limits, it may probably be useful to dipterists studying the fauna of India.

Some changes of nomenc ature are unfortunately necessary, as Professor Bezzi has pointed out that the genus hitherto known as *Argyramœba* should be known as *Anthrax*, while he has, very properly I consider, split up the old genus *Anthrax*. Such changes are very puzzling to students of insects who do not happen to be specialists, but as Professor Bezzi has been followed by Becker in his "Genera Bombyliidarum," which is perhaps the most up-to-date study of the family as a whole, I have consequently followed them in this paper.

The genus *Exprosopa* has, as I anticipated when dealing with its Indian representatives, now been split up by Professor Bezzi (Ann. S. African Museum, Vol. XVIII, p. 138) into several new genera.

Anthrax Scop. (*Argyramœba*, olim).

Before dealing with the Indian representatives of this genus, I should state that in 1908 Professor Bezzi erected a genus *Petrorossia* for the species which had, up to that time, been known as *Argyramœba hesperus*, Rossi. He has since described in Trans. Ent. Soc., 1911, pp. 615-17, several new species of *Petrorossia* from Africa. As representatives of this genus occur in India, it will be necessary to differentiate *Petrorossia* (which Becker places in a different sub-family) from *Anthrax*. The two genera may be tabulated as follows:—

Præfurca long; 2nd longitudinal vein arising from the 3rd opposite or nearly opposite the anterior cross-vein ..	*Anthrax.*
Præfurca short; 2nd longitudinal vein issuing from the 3rd further from the anterior cross-vein than the length of the cross-vein itself	*Petrorossia.*

Anthrax indicata, n. sp.

♂ Head; frons at vertex less than $\frac{1}{6}$ the breadth of head, at level of antennæ about $\frac{2}{5}$; frons and face blackish brown, covered with short stiff black hairs, mixed with a few grey ones near upper mouth edge; a little white tomentum near eye margins; antennæ dull black, 3rd joint onion-shaped, its base with a little grey shimmer, style bisected at about $\frac{2}{3}$ its length, its apex with the usual pencil of hairs; proboscis short, blackish brown; occiput dull black, deeply indented at vertex, with a little white tomentum along eye margins; occipital fringe dark brown. Thorax black, covered above with black hairs, mixed with some greyer ones especially about the pronotal collar; on the disc, especially about the wing bases, there are some very fine short yellowish grey scales; below the pubescence is rather long, entirely grey; scutellum concolorus with thorax, and similarly clothed; the marginal hairs, which are too fine to be called bristles, long and black.

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Abdomen dull brownish black, similarly clothed to the thorax; 1st segment with two small patches of grey scales near the middle of the apical margin, its sides with tufts of long white silky hairs; sides of remaining segments clothed chiefly with black hairs, intermixed with a few grey ones; apical 2 or 3 segments rather denuded, but showing traces of white scales; genitalia red.

Legs black, tibiæ, and tarsi more or less rufescent; coxæ with rather long grey pubescence, femora with white scales; tibiæ with numerous short black bristles; pulvilli nearly as long as claws.

Wings sub-hyaline; the base as far as the humeral cross-vein, costal and subcostal cells, dark brown; on the clear portion are dark brown spots in the following positions: one, connected with the dark costal margin, and carried across base of discal cell as far as the anal cell; one across anterior cross-vein and point of origin of 2nd longitudinal vein, not quite connected with the dark costal margin; one at the point when 3rd longitudinal vein forks; a smaller one at apex of discal cell, and one still smaller at its posterior angle; the 2nd longitudinal vein forks just before the anterior cross-vein, but there is no appendiculation; the upper branch of the 3rd longitudinal vein has an indication of appendiculation; first posterior cell open for nearly the distance of anterior cross-vein; anal cell only narrowly open; base of costa with black bristles; halteres entirely black.

L. 8mm.

Described from a single specimen from Matheran.

This is quite distinct from *A. instituta* Walk., with the type of which I have compared it. It would run into Brunetti's key with *distigma* and *obscurifrons*.

Anthrax argentiapicalis, Brun.

I have a male from Matheran. It is like the ♀ described by Brunetti, except that the frons at level of antennæ is fully ⅔ the width of head; the femora are more or less rufuscent, there are a few white scales on apical border of the 3rd abdominal segment near the sides, and only the knob of the halteres in black, the other being pale.

Anthrax duvancelii, Macq.

I have 3 specimens of this species from Deesa, one of which was bred from the nest of a wasp. They agree absolutely with Brunetti's description except as regards the abdomen, which I should describe as follows:—Black; 1st segment with an apical band of long white scaly hairs, which are longest at the sides; remaining segments with apical bands of white or yellowish-white scales, reaching over the side margins, those on the 3rd and 4th segments being very narrow and sometimes interrupted; bases of segments with rather stiff black hairs.

Anthrax candida, Sack.

(Die palæarktischen Spongostilien, p. 583.)

This species was described from Persia, and Becker records it from Persian Baluchistan. I have two specimens from Quetta which correspond fairly well with Sack's description, except that they are rather smaller than the measurements he gives.

The following abbreviated description should enable the species to be recognised: Frons black-haired; face with grey scales; upper mouth edge with long grey scaly hairs, and a pair of black bristles, the latter not always visible; antennæ black, 3rd joint with a grey shimmer, onion-shaped, with a rather long black pencil of hairs.

Thorax blackish, with white scales and black bristles near wing base and on post-alar calli; sides and below with white scaly hairs. Legs black, with brown tibiæ and tarsi; coxæ, especially the middle ones, with rather long black bristly

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hairs; pulvilli large, yellowish white. Abdomen blackish, extreme spices of most of the segments lighter; 1st segment with grey scaly hairs; 2—4 segments with black hairs, their margins covered with white scales; last 3 segments thickly covered with white scales, the bristles on their apical margins whitish, except for a few black ones in the middle; venter covered with white hairs and scales. Wings hyaline, a little yellowish at base and along costal margin; slight infuscations near base of 3rd longitudinal vein and on cross-veins; base of costa with black bristles and yellowish grey scales.

L. 16 mm. My specimens are about 12 and 14 mm.

Anthrax? subnotata, Walk.

Walker's description of this species was very meagre, and I have not been able to find his type in the B. M. collection. Sack records it with some doubt from Persia, and Becker from Persian Baluchistan. I have 3 specimens from Quetta which correspond fairly well with Sack's description.

Anthrax? isis, Mg.

I obtained at Deesa two specimens which are probably this species.

Anthrax obscura, Sako.

(Die palæarktischen Spongostilien, p. 516.)

I have a specimen from Quetta, and there are in the B. M. five specimens from Chaman, captured by Col. Swinhoe in 1880 ("at Mess, 11 p.m."). Becker records it as common in Persia, Seistan and Persian Baluchistan. I do not think it can be common at Quetta, as I only obtained one specimen during my two years' stay there, and it is so conspicuous that I could hardly have failed to notice it. It need only be contrasted with *A. bipunctata* F., from which it differs in being rather smaller (14-16mm.), having no white pubescence on 1st abdominal segment, and the 1st posterior cell closed. The 3rd joint of the antennæ is onion-shaped in the present species.

Anthrax bipunctata, F.

Brunetti does not mention that the 3rd antennal joint of this species is conica and not, like most of the other species of this genus, onion-shaped.

I have a specimen from Deesa, but have not met with it elsewhere.

Anthrax, sp. inc.

There are in the B. M. two specimens of an Anthrax, standing over the name of *umbra* Walk., one of which is labelled "N. Ind." I have compared these with Walker's type, and they are certainly not that species, though resembling it in size and the colour of the wings. The type of *umbra*, of which the locality was unknown, has the 3rd joint of the antennæ onion-shaped. The two specimens now referred to have only one antenna left, but the 3rd joint of this is conical, and they must thus belong to Sack's subgenus *Satyramœba*, which includes *bipunctata* F. and *etrusca* F. One of the specimens has the abdomen more or less denuded, the other has four minute spots of white scales on the 2nd abdominal segment, and two similar but rather larger spots on each of the remaining segments.

If the locality is correctly given, this species will probably turn up at some future time in N. India, and I therefore call attention to it. The B. M. specimens are not in sufficiently good condition for description.

Petrorossia, Bezzi.

The following should certainly be transferred to this genus:—

Argyramœba claripennis, Brun., described as having the 2nd longitudinal vein originating half way between base of discal cell and anterior cross-vein.

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Argyramœba nigrofemorata, Brun. I have a specimen from Matheran which agrees with Brunetti's description, and is a *Petrorossia*.

Argyramœba intermedia, Brun. I have examined the two specimens in the B. M. and they certainly belong to *Petrorossia*.

Anthrax albofulva, Walk. The type of this species is headless, but the position of the origin of 2nd longitudinal vein marks it as a *Petrorossia*. I have specimens from Deesa which correspond so far as comparison is possible, with Walker's type. The specimens described by Brunetti may not all belong to one species, as he mentions differences in the neuration.

As regards the insect described by Brunetti as *Aphœbantus ceylonicus* (Dipt Brach. Vol. I, pp. 257-9), it is possibly identical with Walker's *Anthrax fervida*. It is certainly not an *Aphœbantus*, as that genus has the 3rd antennal joint conical. I have a single specimen from Jubbulpore which corresponds with Brunetti's description, and there are in the B. M. four specimens named by him. These all have the 3rd antennal joint onion-shaped. The præfurca is even shorter than is typical *Petrorossia*, and the 3rd antennal joint bears a moderately long style, but no pencil of hairs. They are either an aberrant form of *Petrorossia*, or belong to a closely allied genus as yet undescribed.

The following five species belong to genera hitherto unrecorded from Indian limits. I have not thought it necessary to give full generic descriptions, which may be found in Becker's "Genera Bombyliidarum." The figures on the plate which accompanies this paper should enable students of Indian Diptera to recognise the genera *Callistoma*, *Mariobezzia*, and *Heterotropus*. As regards *Eurycarenus*, I have not included it in the plate, being somewhat doubtful whether the Indian specimens obtained by me are conspecific with African ones.

Callistoma imperator, n. sp.

♂ Head; frons below antennæ about half as broad as head, narrowing at vertex to half this width; black; vertex with a rather narrow band of blackish brown hairs, extending to the eye margins; frons and face thickly covered with white scales, and some longer whitish hairs; antenæ black, 1st and 2nd joints with some short black hairs, 3rd joint, excluding style, rather longer than the 1st and 2nd together, suddenly narrowed at about the middle, with a reddish style about half the length of the joint; proboscis black, as long as the head and thorax combined; mouth edge very narrowly testaceous; occiput narrow, with a fringe of white hairs behind vertex, and some short scaly white hairs behind eyes. Thorax and scutellum black, covered with rather short yellowish grey hairs and some whitish scales on dorsum, below and on metapleuræ with longer white hairs; bristles near base of wings, on post-alar calli, posterior margin of dorsum, and scutellum, pale yellow.

Abdomen black, long and rather narrow; 1st segment rather thickly covered with greyish white hairs of moderate length; 2nd and following segments with rather narrow basal bands of depressed greyish scales; beyond these bands the hairs on the abdominal segments are short, black and depressed, and each segment except the first has a complete apical row of long yellowish bristly hairs; the sides of the abdomen are thickly covered with moderately long greyish white hairs; ventral segments 1—4 with the apical half of each segment covered with snow-white scales.

Legs black; femora and tibiæ with greyish scales and rather short black spinules.

Wings hyaline with a broad moderately dark band across the middle, its outer boundary being at the apex of 1st longitudinal vein; it includes the whole of discal cell, but is slightly narrowed towards the posterior margin of wing; base of wing as far as the humeral cross-vein, and the costal and subcostal cells, light brown; alula smoke brown, with dark fringe, base of costa with

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rather long black bristles and a few grey scales; halteres brownish, pale yellow at tip.

♀ Similar; vertex and abdomen much broader; the abdominal bands of greyish white scales rather broader than in the ♂.

L. 18 mm.

Described from 2 ♂ ♂ and 1 ♀ in good condition obtained at Quetta in April and May.

Callistoma may be recognised from other *Anthracinæ* by the long proboscis, narrow abdomen, and radial vein diverging from the præfurca well before the discal cross-vein. The 1st posterior cell is closed and long stalked. The present species is much larger than any previously described in this genus, none of which exceed about 12mm. in length. The 4th posterior cell is twice as wide at base as at apex, whereas in *C. fascipennis* it is only 1½ times as wide. The 1st posterior cell is closed nearer to the wing margin in my two ♂ ♂ than in the ♀, but this may be only an individual variation.

The larva of the European species (*C. fascipennis*) is reported (Tr. Ent. Soc., 1881, XIV) to be parasitic on the egg cases of locusts. The genus appears to be confined to Eastern Europe and Western Asia.

Mariobezzia griseohirta, n. sp.

♂ Head; eyes separated at vertex by about $\frac{1}{5}$ the breadth of head, frons and face gradually widening towards mouth edge; vertex narrowly black, the colour extending over the occiput; frons and face whitish, the raised portion between the base of antennæ and mouth edge reddish brown, with a darker line down the middle; antennæ black, 3rd joint three or four times as long as the first two together, style very short; the facets on the lower third of the eyes are much smaller than those on the upper two-thirds; the cheeks from the lower portion of eyes to the mouth edge, and the proboscis dark brown; face, frons, and occiput covered with greyish pubescence.

Thorax and scutellum entirely black, with rather long grey pubescence. Abdomen black, the apical margins of segment 1—3 with narrow white transverse bands, 4th segment at apex narrowly testaceous; venter black, with apical margins of first four segments more or less pale; the whole abdomen covered with grey pubescence.

Legs; coxæ and femora, except the extreme apex of the latter, black with grey pubescence; tibiæ pale at base, darkening towards apex; tarsi dark brown.

Wings hyaline, with a suffused patch or band from anterior margin towards discal cell, blackish on margin, becoming gradually less dark, and hardly noticeable beyond discal cell; nervures pale, tegulæ dark, halteres creamy white.

L. 6 mm.

Described from one specimen obtained at Quetta in May.

This species is much darker and more pubescent than either *lichtwasdti*. Beck or *zarudnyi* Beck, both of which are bare, and have the thorax mainly yellow. As regards neuration and the shape of the face it exactly agrees with Becker's description of the genus in Genera Bombyliidarum, p. 470.

Heterotropus indicus, n. sp.

♂ Head; pale green, eyes touching for a space rather shorter than the vertical triangle, which is distinctly raised, and on which there are a few pale hairs; antennæ with the first joint pale green, the 2nd similar but rather darker above, 3rd joint pale yellow, the latter, excluding style, nearly twice as long as the other, two taken together; style pale red, about $\frac{1}{3}$ as long as 3rd antennal joint; proboscis and palpi yellow, the former dark brown at apex; eyes with the lower third divided from the upper portion by a fine line, the facets on the lower part very fine; above this line the facets are much larger about the middle of the eyes, decreasing in size on the upper third; occiput with fine soft pubescence.

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Thorax and scutellum pale green, with short pale pubescence; dorsum with three brown longitudinal lines, the middle one shorter than the outer ones, none of them reaching the scutellum; (these lines are often almost or quite obsolete, but usually traces of them may be observed).

Abdomen concolorous with thorax, with similar pubescence, and a double series of small black longitudinal spots on segments 3—7 inclusive, but these are sometimes obsolete, or the whole abdomen may be more or less darkened. Legs pale green, with short soft pubescence; fore coxæ very long, more than half as long as femora; motatarsi, except apex, pale, remaining tarsal joints blackish brown.

Wings clear hyaline, all nervures pale, halteres light yellowish green.

♀ Similar to the ♂, but abdomen without dark markings, and those on the thorax very faint or obsolete; the distance between the eyes at vertex is about $\frac{2}{3}$ the total width of head; the frons and face widen slightly towards the mouth edge; the facets of the eyes are of equal size throughout.

L. 6-8 mm.

Described from 9 specimens from Deesa, most of which were obtained at flowers of *Calotropis gigantea*.

Only two species of this genus have hitherto been described, *viz.*, *H. albidipennis* Lw. and *H. glaucus* Beck. The present species differs from both the above in its larger size and much lighter colour.

Heterotropus pallens, n. sp.

♂ Superficially very like *H. indicus* described above, but differs structurally as follows: eyes touching for only a very short space; upper mouth edge considerably produced; 3rd antennal joint longer, but terminal style shorter; first joint of antennæ and apical third of 2nd joint pale, remainder of antennæ reddish brown, style about $\frac{1}{3}$ the length of 3rd joint; the lower third of the eyes is divided from the upper portion by a fine line as in the preceding species, but the facets are of approximately equal size on the upper two-thirds. Thorax with some indications of two darker longitudinal lines, abdomen with longer pubescence and no black markings, though segments 1—3 at base appear somewhat darker underneath the pubescence; tarsi much lighter, the first four joints at apex narrowly, and the whole of the 5th joint reddish brown.

♀ Similar to the ♂, but the production of the upper mouth edge is much more noticeable, being almost rostrate; viewed in profile it equals about $\frac{2}{3}$ the short diameter of the eye. The eye facets are more or less of equal size throughout.

L. 6-8 mm.

Described from 1 ♂ and 2 ♀ ♀ obtained at Quetta in May.

Eurycarenus ? laticeps, Loew.

This species was originally described from S. Africa, and appears to be widely distributed in E. and S. E. Africa. Bezzi records it from Nigeria and Kordafan, and there are specimens is the B. M. from Natal, Rhodesia, and Nyasaland.

I can detect no difference between my Indian specimens, obtained at Jubbulpore, and those from E. Africa, but my only ♂ is not in good condition, and I am inclined to think that the males of this genus differ more than the females. Bezzi wrote in Tr. Ent. Soc., 1911, p. 613, that only one species of this genus was known, as he considered that *E. pachyceratus* Big. may belong to another genus. I have, however, recently seen in the B. M. specimens from Africa, to which he has given new names, and which will presumably be described by him in due course. Colonel Yerbury informs me that a species of *Eurycarenus*, which he believes to be undescribed, occurs at Aden, and it is quite possible that the Indian specimens may prove to belong to a distinct species when males in good condition are available for examination.

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DRAGONFLY COLLECTING IN INDIA.

BY

MAJOR F. C. FRASER, I.M.S., F.E.S.

(*With 3 text figures.*)

I. The Pros and Cons of Dragonfly Collecting.

Col. Evans in his able and helpful papers on collecting and identifying Indian butterflies has much simplified my task of writing a similar paper on Indian dragonflies.

Much of what he has said with regard to the distribution and evolution of butterflies is also applicable to the Odonata or dragonflies and it would be mere plagiarism were I to repeat it.

I shall therefore confine my remarks to these two aspects in only so far as they differ from butterflies.

Dragonflies are so familiar an item of the Indian land or waterscape that there is little fear of mixing them up with any other insect, nevertheless I am continually receiving specimens of ant-lions from amateur collectors, sent to me under the belief that they are really dragonflies. Ant-lions can be readily distinguished by their long antennæ (or "feelers" as they are popularly called) which may or may not be clubbed. In dragonflies the antennæ are very tiny objects and can be seen with difficulty. There are practically no other insects with which they may be confused even by amateurs. I shall go further into the structure of a dragonfly when discussing the question of classification.

These insects are not nearly so popular with collectors as are butterflies or beetles and if one seeks to find the reason for this, they will be found to be any of the five detailed below. If I can dispel these seeming drawbacks I feel sure that many a collector, who has up to the present been confining his attentions to one of the more popular groups, will bestow a little time to the study of a much more interesting order of insects and thus find an added zest to life in the tropics.

(i) There is a mistaken belief that the species are few in number and that a collection would soon be so complete as to lose interest. Amateurs examining my collection nearly always express their astonishment at the great number and variety of dragonflies found within Indian limits, which now number close on four hundred species.

(ii) The brittleness and fragility of the insects which render them difficult to keep satisfactorily, especially by those who are accustomed to lengthy and frequent transfers.

Kept and stored as detailed below, dragonflies will stand far more knocking about than a collection of butterflies. I frequently receive store boxes full of specimens and not a single one has been damaged or shaken loose, a striking testimony when one considers the merciless treatment meted out by the Indian Parcel Post. Dr. Ris tells me that he has sent large parts of his collection from Switzerland to America and back again without a single specimen being damaged.

(iii) The rapidity with which the beautiful colours fade after death, thus rendering the insects comparatively unattractive objects in a collection.

Prepared as detailed below the colours may be retained after death almost as vivid as they were in life. Colouration however is not the only attraction of a dragonfly, the real beauty and interest lies in its wings, the study of the venation of which is one of the most fascinating branches in the study of evolution of species.

If as it has been truly said, the story of evolution is written on the wings of a butterfly, then it is doubly so on those of the dragonfly.

(iv) The large amount of room they take up when set out in store boxes, which is, it must be admitted, a serious objection. Especially is this so to the civil servant or military officer who is accustomed to frequent transfer from place to place. Store boxes multiply and take up a lot of room, which adds considerably to one's kit.

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Personally I have given up setting out my specimens, as dragonflies lend themselves peculiarly to a paper collection.

In store boxes it is best to set out three specimens of each insect, two males and a female. The former are placed side by side facing forwards, the latter between them facing in the opposite direction—the three thus forming a compact group. I have also tried removing the wings of one side which detracts but little from the value of the insects and almost doubles the accommodation of a store box. The wings removed are kept in an album secured by a spot of cement at the base and thus form a very interesting collection illustrating the evolution of a dragonfly's wing.

A paper collection however will be found the most satisfactory for the worker in this country, not only on account of its compactness but its readiness to access and reference. Dr. Ris, the greatest living authority on dragonflies, tells me that he has long ago given up setting out his specimens and now keeps them entirely in paper.

Two cabinets of ten drawers each will accommodate about one thousand specimens and will take up only about two cubic feet each.

The dragonflies with the wings folded flat are put into paper packets of the "cocked-hat" type described by Col. Evans in his paper on Indian Butterflies. I use clean foolscap for this purpose and as dragonflies vary enormously in size, make my packets after each shikar to suit the size of individual specimens. Each paper packet is now put into an envelope on the front of which is written (typing looks neater) the name, sex, place, altitude, date of capture and name of collector and lastly any brief notes that may be of interest. Envelopes of 5×3 inches are the most suitable to use. The drawers of the cabinets are made of a size to accommodate these and each should be long enough to hold about fifty envelopes. The drawers have labels on the front indicating the families to which the species belong. The cabinets should have a pair of folding doors in front to lock and enclose all the drawers. This will keep out damp and facilitate packing when moving about country.

The dragonflies are arranged firstly according to families and the families in alphabetical order so that a very complete index system is obtained enabling one to pick out any particular specimen at a glance. In addition I also keep a card index, corresponding to the arrangement of the collection, which enables me to make any notes and thus keep a complete history of the collection.

Dragonflies keep well and look extremely neat in a collection of this sort and as the majority have clear wings, nothing is hidden or lost to view by folding the latter. To examine the venation all that is necessary is to run a small slip of notepaper between the two pairs of wings and the veins will stand out clearly on the white background. In the case of species which have the wings coloured or opaque, one pair of the wings may be removed so that both sides of the remaining pair are brought into view.

I find that a small printing outfit, to be purchased for a few rupees, saves a lot of time in labelling the paper packets. After a day's shikar which has been conducted in one locality, it is only necessary to prepare one stamp and impress the packets rapidly. If a large variety of species has been taken, it will be found quicker to write in the name of the species in lieu of assembling the type for each, but all other data such as the locality, date, etc., can be stamped on.

(v) The last and perhaps the most serious drawback must now be dealt with. This is the scarcity of literature on the subject and the want of names to give our species, as well as the difficulty of identifying them. The absence of literature forces the collector to fall back upon one of two expedients, either he must send his captures to an expert for identification or he must compare them with those of a named collection. There are several of the latter in India and the most complete are those of the Indian Museum and Pusa collection. Smaller collections are to be found in the Forest Research College at Dehra Dun and in the Bombay Natural History Society's Museum. My own collection, which is nearly complete, is always at the service of collectors who may care to use it,

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and I am always pleased to identify and return specimens sent to me for that purpose through the medium of the Bombay Natural History Society.

Literature on the subject is extremely scattered, many of the most important works now being out of print. Descriptions of Indian species have to be sifted out of a great mass of literature, mostly papers in Journals or Works on the world's dragonflies written in a foreign language and many of these difficult or impossible to obtain. Descriptions of Indian species will be found in the following works :—

Rambur, Ins. Nevrop., published in 1842.

Baron Edmond de Selys' Monographs on the *Gomphines* and *Calopterygines*, published in 1857 and 1854 respectively.

By the same author, the Synopses on the *Calopterygines*, *Gomphines*, *Aeschnines* and *Agrionines*, published from 1850 to 1876.

Dr. Ris' monumental work on the *Libellulinæ*, Cat. Coll. de Selys, IX-XVI, and his addenda, published from 1909-1916.

Martin's companion work on the *Aeschnines* and *Cordulines*, Cat. Coll. de Selys, published in 1909.

Dr. Laidlaw's notes on Indian Dragonflies, published in the Records, Indian Museum, continuously from 1914 to 1921.

Williamson's Dragonflies of Burma and Siam, *Gomphines* and *Calopterygines*, published in the Proc. U. S. Nat. Mus., 1904.

"Indian Dragonflies," a series of articles which have been appearing in this Journal since 1918.

Lastly there are a number of individual descriptions which have appeared in numerous journals at Home and abroad by distinguished entomologists like Kirby, MacLachlan, Karsch, Calvert, Brauer, Hagen, Charpentier and others.

For purposes of identification however this literature will be superfluous if the amateur will only take the trouble to master a few necessary terms, the employment of which is essential in describing dragonflies. A knowledge of these terms will enable anyone to work out for himself the identification of any species by employing the key given at the end of this paper.

Having dealt with the seeming drawbacks of dragonfly collecting, let me now say something in compensation of the pursuit.

(i) Dragonflies can be handled with impunity without fear of rubbing off their beautiful plumage, there are no coloured scales for careless handling to remove, and a cyanide bottle can be filled to the brim and emptied out at the end of the day without revealing a mass of mangled and spoilt specimens.

(ii) They are far swifter and more cunning and wary on the wing than butterflies and to those who possess the instincts of the shikari or fisherman will afford abundant sport. In 1917 when on War leave in Coonoor I used to run down daily to Kallar at the foot of the Nilgiris. It was here that I one day spotted a dragonfly (*Onychothemis tonkinensis*) which had not hitherto been taken within Indian limits. I failed to take it on the first day but saw it near the same spot on the following and again failed to secure it. On the third day I once more put it up and after wading about up to my hips in the Kallar river for the best part of two hours finally succeeded in taking it. Approaching it from behind, it would wait until I was about five yards off and would then move up stream for some thirty yards. When I was almost within striking distance again, it would take a chakar round me and move off down stream again to its original resting place. Struggling deep in the water, barking my shins on submerged rocks or tripping over them, hot and perspiring, I at length secured my specimen by stooping under the overhanging lantana bordering the stream and working my way steadily towards the insect until I was directly under it. Experience has taught me that dragonflies can see very little below them and I took this particular one with a swift upward stroke. I probably spent four hours on the successive days stalking this specimen which is the only one that has been seen or taken within Indian limits. What finer and more exciting sport could one desire than this ? And you have something unique to show for it at the end

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of the day! I can still remember the thrill I experienced when I finally bagged my prey. I have had many such thrills before and since.

(iii) Besides the sport of collecting and the collection itself there are other interests underlying the study of dragonflies. These insects on account of their naked and strongly veined wings have lent themselves peculiarly to the formation of geological specimens. Thus a very large percentage of insect fossils are those of dragonflies and we are enabled with the mass of material available, to trace their evolution in an almost unbroken chain of descent down to modern times. The venation is so diverse in spite of the basic scheme which runs through all, that even in modern species we can trace a chain of descent beginning from those resembling fossil species and ending in a very highly organised and structurally perfect wing. Some present day dragonflies are so much akin to fossil species that they must be regarded as survivals from the past and here in India we find several of these. Any one who has the time and opportunity to visit the British Museum should pay a visit to the lower insect galleries where I am sure Mr. Herbert Campion will only be too pleased to show him the beautiful collection of fossil dragonflies. Here one will see the wings delineated on the slates of Solenhofen with the most wondrous exactitude.

(iv) Dragonflies are amphibious insects spending the greater part of their life in a watery element. The larvæ are chitinous or horny insects and, unlike those of butterflies or moths, can be preserved in the dry state without any difficulty. It is true that they are not objects of beauty but what they lack in this respect they more than compensate for by their interesting and curious formation. They have no resting stage corresponding to the pupal or chrysalid state of the Lepidoptera but change direct from the larva to the winged insect. When a larva prepares to change into the aerial form, it climbs out of the water and ascends some reed or rock bordering the pond, tank or river in which it has been living, and it is in such places that the empty shells or "exuvia" as they are called must be sought for. The exuvia make very interesting objects in a collection and can be mounted alongside the corresponding dragonflies.

If one of the exuvia or larvæ be examined they will be found to possess short wing cases and if these be further examined, it will be seen that they bear an exact repliqua in minature of the destined venation of the dragonfly that has or will eventually emerge from it. Thus it is often possible to tell by an examination of the wing cases to what species the larva or exuvia belongs, even if we have not seen the actual dragonfly emerge.

In June 1918 Dr. S. Kemp of the Zoological Survey of India whilst hunting for exuvia and larvæ near Ghum in the Himalayas fished up a specimen which looked very much like a Gomphine larvæ. This has since been determined by Drs. Laidlaw and Tillyard as the larva of a new Epiophlebia, the venation of its wing cases corresponding to that genus. There is only one species at present known of this very interesting genus, which forms a connecting link between the two big suborders into which dragonflies are divided. This species, which is the only representative of its suborder known to exist in the world, is found in Japan, so that the discovery of a larva pointing to the existence of a second species is of absorbing interest. The winged insect belonging to Dr. Kemp's larva is so far unknown—what a prize awaits the collector in that district ?

In the Nilgiris last year I came across a new *Anaciaeschna*, a fine large species marked in dark brown and bright apple green. All the specimens were females and so far not a single adult male has been seen. The larvæ however were easy and plentiful to obtain and from these I have succeeded in rearing males. Thus it is possible for any collector to obtain larvæ and possibly rear up unknown or rare species. Dragonflies present many curious and puzzling problems like those mentioned above, the larvæ of some of our commonest species being unknown whilst the larvæ of some of the rarest may be quite common.

(v) The Lepidoptera of India have been worked almost dry, the study of her dragonflies remains in its infancy, much remains to be solved of their life-histories, many new species remain to be discovered so that there is always the

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pleasant anticipation of coming across "something new." A new butterfly is a rare event now-a-days but new species of dragonflies are constantly being discovered. Since I have been in the Nilgiris, a space of only one year, I have found no less than ten new species and have received a larger number than this from various parts of India and Burma.

(vi) The distribution of species is another interesting point on which amateur collectors can help to give information. Less than six years ago, *Hemicordulia asiatica* was only known from a couple of male specimens taken in Assam. Since then Mr. Bainbrigge Fletcher, the Imperial Entomologist, has rediscovered it in Assam and last year found it fairly common at Kodaikanal in the Palni Hills. Since then I have found it quite common in the Nilgiris, a species which was thought to be confined to the far North. *Hemicordulia* is an Australian genus so that it is evident that it has spread from the south to the north and I have no doubt but that we shall shortly hear of it from Ceylon and possibly Java.

II.—*How and Where to Collect Dragonflies.*

A few words first about the equipment the dragonfly collector needs. I usually carry a small haversack fitted with three small and one large pockets. In the small pockets are a couple of cyanide killing bottles to be obtained from any chemist and an empty large mouthed bottle fitted with a cork for carrying larvæ in. In the large pocket is a small folding net of muslin and another with a strong iron rim, the material forming the net being strong, rather open, dungaree. This latter is used for dredging for larvæ. A few small tins (Colgate's shaving stick tins are very useful) are also carried in the large pocket for holding the surplus of our captures and any exuvia that may be happened upon.

For all round work I use a large net of somewhat different type to that described by Col. Evans in his paper on collecting butterflies. I find the weak part of his net is where the cane fits into the arms of the Y-piece. The constant swaying backwards and forwards of the net when in play, soon causes the cane to split and break at this point. To remedy this defect I had a Y-piece made with the stem prolonged beyond the arms of the Y as shown in the diagram (Fig. 1). The stick runs right through the Y and is carried across the centre of the net to fit into a T-piece at the top. The cane is fitted into the arms of the Y and runs clean through the arms of the T-piece. Such a net is absolutely rigid and strong enough to last for years. My present one was made by a tinsmith in the Trichinopoly bazaar fourteen years ago. The stick in the middle of the net is no draw-back as one very rarely strikes a specimen with it and even when this happens, the insect passes on into the net without any appreciable damage. The measurements are 2 by 1½ feet and the material ordinary mull. Mosquito netting is useless as it is terrible stuff to rip in the length and if you bump up against lantana or other thorny bushes your hunting is over for the day.

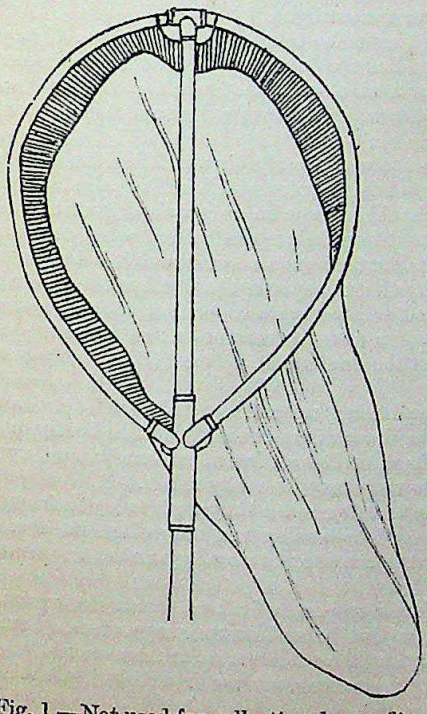

Fig. 1.—Net used for collecting dragonflies. Note the three-armed Y-piece and the top T-piece.

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An extension to the stick as described by Col. Evans is useful but must not be too long or you will lose the nice balance a net should always have. Mr. Bainbrigge Fletcher always uses a small folding net which clamps on to the end of a stick. I always carry one of these as a spare and can catch most things in it. Mr. Fletcher is very expert in the use of this net which can be purchased at the Army and Navy Stores or any Entomological dealers.

Dragonfly larvæ must be dredged for, as they lie up in weed or burrow in the muddy bottoms of streams. Leafy debris in pools of streams is a fruitful source for some species, whilst others cling to rocks and unless seen are difficult to obtain. The mass of weed, leafy debris or mud must be spread out on a cleared spot of ground and left for a time as most species feign death after being taken from water. As soon as they begin to dry, they are stirred into activity and can be easily detected.

Exuvia must be sought for clinging to reeds, grass, sedges or water plants, whilst others invariably ascend rocks bordering the tanks and streams they inhabit. Others scale trees and I have found exuvia at a height of over six feet from the ground.

Young larvæ unless rare or wanted for study should be replaced in their watery home, adults being the most likely to breed out into the winged state. Larvæ must be kept in surroundings closely assimilating those from which they have been taken and frequent æreation is essential. Weed should be added to the breeding tanks for this purpose and water poured in from a height daily. Too many larvæ must not be kept in one tank as they are terrible cannibals, and rarities are best kept apart or they may fall victims to other commoner species.

When dragonflies emerge they are soft, colourless insects and take some time in drying. At least 48 hours are necessary for the colours to develop and for this purpose I place my specimens in a warm sunny room where they can fly about or cling to the curtains exposed to the sunlight.

When netting dragonflies full account must be taken of their habits. Many species never come to rest save at the end of the day or when the sun goes in and then vanish to the depths of jungles or ascend far out of reach to the tops of trees. These must be taken when on the wing and it is safer to strike at them from behind.

A full face shot at a swift species on the wing nearly always fails, it is best to let them pass and then follow up with a swift stroke which will usually be successful. In stalking a dragonfly, it should always be approached from behind or below ; from behind when in flight and from below and behind when at rest.

Other species take short flights with frequent rests and for such it is better to allow them to come to rest before attempting to capture them, when they should be approached from below and behind where possible. Other species again, like butterflies, show great inquisitiveness and the steady, slow approach of a net appears to fascinate them so that the final stroke is almost invariably successful.

Small species have frequently to be beaten up and are taken without any difficulty. Night flyers lie up under the cover of bushes and must be beaten up. Such species when roused soon seek a fresh shelter and with care and a keen eyesight are traced to their new lair where they may be easily taken.

Females as a general rule, only come to water when they wish to lay their eggs and so are less often seen than males. The weaker sex may often be found hiding up in jungle adjacent to water supplies and are usually perched on prominent or bare and dead twigs.

Every large body of water will be found to possess its own fauna, determined by the factor as to whether the larvæ live in still or running waters. Some species of dragonfly are often found flying in local swarms far from water, *e.g.*, *Pantala flavescens*, which I have never once seen over water although probably the commonest dragonfly in India.

Modern species usually frequent open or cultivated areas, whilst archaic ones keep to jungles and jungly streams. Weedy ponds are better than weedless ones, probably because the latter give no shelter to the larvæ.

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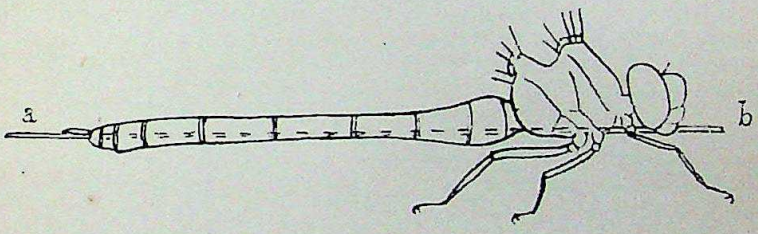
Some species are cryptic in colouring and take advantage of this by selecting appropriate coloured surfaces to settle on, such as slab-rock, whilst others lurk in dark, shadowy spots amongst the rocks of mountain streams.

The ends of the two monsoons are the two best times of the year for taking dragonflies' and the close seasons between these periods the best time for hunting for larvæ, so that one never need be idle—collecting can go on all the year round.

At the end of the day's shikar no time must be lost in preparing the captured specimens for the store box or paper collection. The abdomen contains a large mass of food and that of the female a large mass of eggs as well. This soon decomposes and unless removed leads to complete loss of colour in the specimens. The larger ones must be treated as follows :—With a pair of sharp pointed scissors open the abdomen below, at a point where it joins the thorax and slit it up as far as the anal end. In the case of the male avoid cutting through the genitalia which will be found beneath the 2nd segment from the thorax, and in the case of the female, below the 8th and 9th segments from the thorax—these structures should have the incision curved round them.

Now with a pair of forceps, seize the gut near the thorax and draw it out completely in its length. The eggs should be scraped out with the blunt point of the forceps. The procedure sounds tedious and difficult but it is simplicity itself, especially with a little practice, and occupies only a minute or so. Small species do not lend themselves to this treatment so must be strengthened by passing a bristle (hog's bristles or stout horse-hair are the most suitable) through the thorax and running it along to the end of the abdomen. The bristle should be sharpened by cutting it obliquely with scissors and must be entered between the second pair of legs, that is at the juncture of the prothorax with the thorax



[Fig. 2.—*How to bristle a dragonfly.* The bristle *a-b* is passed through the body from between the second pair of legs to the end of the abdomen. The parts at *a* and *b* are merely shown to give the direction of the bristle, that at b being cut off as soon as the bristle reaches the end of the abdomen.]

as shown in the diagram (Fig 2). After this is completed the specimens can be put to dry in powdered napthaline which I find the best preservative for colours in the smaller species. A spirit collection of the smaller species may be made by putting them up in lengths of glass tubing and sealing off the ends in a blow lamp. They keep their colours absolutely perfect in spirit.

Rapid drying after cleansing is essential for the preservation of colours and after papering my specimens I drop them into an ordinary drying tin as used for drying cigars for a few days. In the dry hot weather which one gets in the plains this is badly necessary as specimens dry rapidly and often preserve their colours absolutely intact.

To keep out mould or mites I find the best plan is to remove the drawers from the cabinet periodically and paint the recesses with creosote. Each drawer is thus surrounded with an atmosphere of creosote vapour which will sterilize moulds and kill off mites.

III. Classification of Dragonflies.

Dragonflies belong to the order Odonata and this is again split up into two large suborders :—the *Anisoptera* and *Zygoptera*.

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Anisoptera have the fore and hind-wings unequal, the base of the hindwing being with rare exceptions much broader than that of the fore. The eyes, except in one family—the *Gomphinæ*, are always more or less in contact with one another.

Zygoptera have both wings of the same shape, the hind in some species may be broader but the base is invariably narrow. The eyes are invariably separated.

For further classification it is necessary to master a few terms which with very little mental effort one soon grows accustomed to.

The venation of the wings forms the main basis of classification, so must be studied in particular.

1. The Wing.

The foreborder of the wing is called the "costa," the hind, the "termen." The part nearest the body, the "base," and the part most remote, the "apex." Near the apex, on the costa will be seen a small opaque, thickened part, varying in shape, sometimes long and narrow, sometimes nearly square, rarely in one of the sexes (female) absent altogether. This is called the "pterostigma." The

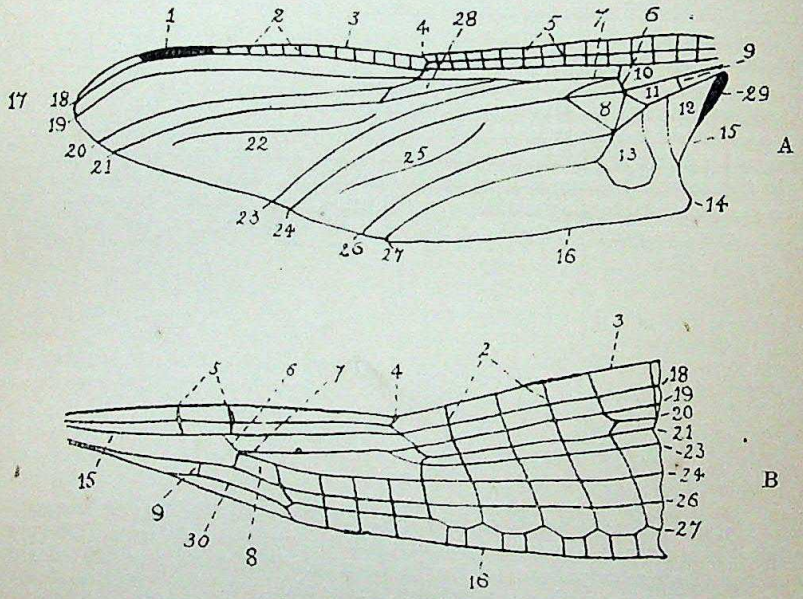

Fig. 3.—*A*. Wing of an *Anisoptera*. *B*. Wing of a *Zygoptera*. (Only the base is shown.)

1. *Pterostigma*, 2. *Postnodal nervures*, 3. *Costa*, 4. *Node*, 5. *Antenodal nervures*, 6. *Arc*, 7. *Sectors of arc*, 8. *Trigone* in the Anisopterous wing, *Quadrilateral* in the Zygopterous, 9. *Cubital nervure* (known as *ac.*). 10. *Median* or *arcular space*, 11. *Cubital space*, 12. *Anal triangle*, 13. *Loop*, 14. *Tornus* or *Anal angle*, 15. *Base* of wing, 16. *Termen* or posterior border of wing, 17. *Apex* of wing, 18. *Radius*, 19 *Mi*, 20. *Mii*, 21. *Rs* or *Radial sector*, 22. *Rspl.* or *Radial supplement*, 23. *Miii*, 24. *Miv*, 25. *Mspl* or *supplement to Miv*, 26. *Cui*, 27. *Cuii*, 28. *Bridge*, 29. *Membrane*. 30 *Anal bridge* (known as *ab.*)

nervures are best learnt from a study of the text figure (Fig. 3) but the spaces at the base of the wing must be noted. A well marked triangle will in particular be noted in the *Anisoptera* which is known as the "trigone."

The space immediately above the trigone is called the "hypertrigone," whilst the space below and behind it is the "subtrigone." The upper border of the

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trigone and one other nervure spring from a small, oblique nervure called the "arc" and the space basal to this is called the "arcular space," whilst the space immediately below this latter is the "cubital space."

About the middle of the costa will be seen a kind of rigid joint which is called the "node" and the small vertical nervures internal to this are called the "antenodal nervures," whilst those external to it are the "postnodal nervures." The antenodal nervures are split up into two sets by a nervure which runs transversely through them and it is to be noted that in some species the two sets correspond whilst in others they do not, that is, they are independent of one another.

In the *Zygoptera* the place of the trigone is taken by an oblique or squarish space called the "quadrilateral" and the adjacent structures are modified as will be seen in the figures.

2. The Head.

The head consists largely of two large compound eyes, the "occiput," lying between and behind them, and the "face." The latter is made up of the lips (labium and labrum—lower and upper lips), the "nasus" or "epistome" which corresponds to the position of the nose and lastly the upper part of the face or forehead which is known as the "frons" (Fig. 4).

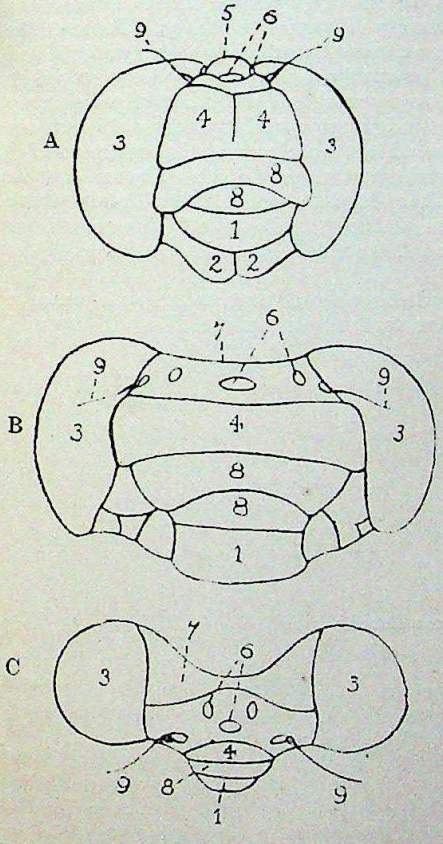

Fig. 4.—*A*. Head of an *Anisoptera* full face. *B*. Ditto (*Gomphine.*) *C*. Head of a *Zygoptera*.

1. *Labrum* (or upper lip), 2. *Labium* (or lower lip), 3. *Eye*, 4. *Frons*, 5. *Vesicle*, 6. *Ocelli* (or accessory eyes), 7. *Occiput*, 8. *Nasus* or *epistome*, 9. *Antennæ*.

3. The Thorax.

This is made up of a small part immediately behind the head, the "prothorax," which bears the first pair of legs and a large bulky part carrying the second and third pairs of legs and the two pairs of wings, the "synthorax."

The posterior part of the upper surface of the prothorax is of importance in some species for purposes of classification, and is known as the "posterior lobe."

The front and upper surface of the thorax is its "dorsal" surface, whilst the part to one side of this, corresponding to our shoulders, is called the "humeral region." The sides posterior to this region will be seen to have two false joints, the "sutures."

The legs consist of the same parts as in the butterfly, *viz.*, the "coxa," "trochanter," "femur," "tibia" and "tarsus" or "claws." The femur, tibia and the shape of the claws are the only parts used in classification.

4. The Abdomen.

This is the long, narrow part immediately following the thorax and is made up of ten segments. The abdomen may be moderately short and stout, or long, or excessively

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long and narrow. At the extreme end, jutting out from the tenth segment, will be seen two pairs of appendages ("anal appendages") in the male, and one pair in the female, which vary enormously in shape in different species. These appendages are used by the male for seizing the female prior to copulation. This it does by encircling the female at the junction of the prothorax with the thorax, that is just behind the posterior lobe of the prothorax. Beneath the second abdominal segment of the male will be found the genital organs, whilst in the female these will be found under the 8th and 9th segments. The female organ consists of a more or less well-developed ovipositor, small in some species, enormously developed in others. On the sides of the 2nd segment in some species, will be seen two curious, ear-like processes which are known as the "auricles."

5. The Larva.

In the adult insect it will be noticed that the head is remarkably mobile, but in the larva, the head, prothorax and thorax are more or less fused and immobile. The wing cases of the larvæ must be noted although they are not very apparent in very young larvæ. The antennæ here are much larger and more evident than in the adult insect and show marked family differences in shape. Beneath the head will be seen the "mask" or labium or lower lip, which is a highly specialized organ used for the capture of prey. It is capable of extension by means of joints and fitted with nippers or formidable jaws by means of which, it grips its prey as the mask unfolds and shoots out with lightening rapidity. The shape of the mask varies widely in different families and is a useful means of classification.

All the larvæ of the *Anisoptera* breathe by means of the rectum but the Zygopterous larvæ have curious, leaf-like gills at the end of the abdomen which carry out this function and are known as the "caudal gills." These number two or three according to sub-families and serve to distinguish the larvæ of the three sub-families.

The comparatively few terms explained above should serve to help the amateur to read the keys which follow but for further convenience I shall append a glossary at the end of the latter.

(*To be continued.*)

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INDIAN DRAGONFLIES.

BY

MAJOR F. C. FRASER, I.M.S., F.E.S.

(*With* 3 *Text-figures.*)

(*Continued from page* 620 *of this Volume.*)

Part XIV.

Family—AESCHNIDÆ (Cont.).

Since the Ms. of Part XII went to the press, Mr. C. F. Beeson of the Forest Research Institute, Dehra Dun, has sent me several new species belonging to the family *Aeschnidæ* and as these have not yet been described, I take this opportunity of including them in our list.

Gynacanthæschna viridifrons, sp. nov.

1 ♂ Gahan, Bashahs Div., Burma, 26, IX, 21, coll. C. F. C. Beeson.

Type deposited in the Forest Research Institute, Dehra Dun.

(The specimen is somewhat crushed or flattened out by pressure in the paper packet, so that the shape of the head is doubtful.)

Abdomen 41 mm. Hindwing 40 mm. Anal appendages 4 mm.

Head. Labium bright citron yellow, labrum greenish yellow, narrowly bordered with black; epistome similarly coloured; frons above bright greenish yellow changing to olivaceous brown in front; eyes dark brown; occiput greenish.

Thorax dark brown marked on the dorsum with a bright yellow, antehumeral stripe, square at both ends, a small spot of the same colour just above the upper end of the stripe and also the antealar sinus. Laterally the whole of the metepimeron grass green as is also a broad, posthumeral stripe.

Legs dark reddish brown, the distal ends of femora and tarsi black. Hind femora with a row of extremely closely-set spines and two large ones at the distal end.

Wings hyaline, stigma black, small, exactly similar to that of *G. sikkima*, the brace meeting it distal to its proximal end; nodal index:— $\frac{15-19}{17-15} \mid \frac{19-15}{14-16}$ 3-4 cells in trigone of forewing, 4 in that of hind; 3-4 median nervures in forewing, 5 in the hind; 6-7 cubital nervures in forewing, 5-6 in the hind; 5-6 cells in the loop; *Rs* forked a long way before the stigma; membrane white; hypertrigones traversed 3 times in forewing, 3-4 times in the hind; anal triangle with 4-6 cells.

Abdomen reddish black to blackish brown marked with grass green as follows: the sides of segment 1 and 2 and the middorsum of the latter narrowly, segments 3 to 7 have the middorsal carina and a fine, apical, dorsal annule, segments 8, 9 and 10 have the dorsal carina finely yellow and 8 and 9 have also a lateral comma-shaped spot at the basal end.

Segment 10 strongly keeled.

Anal appendages. Superior nearly as long as the last two segments, curved, broad at the base, narrowing and flattening afterwards and dilating gradually

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towards the apex which is blunt, black. Inferior triangular, two-thirds the length of superior, bright yellow, curling strongly upward.

Distinguished from *sikkima* by the bright colour of the lips and frons also by the blunt tipped anal superior appendages, etc.

Anax goliathus, sp. nov.

1 ♀ Magayi, Insein, Burma, 30, XI, 21, at dusk, coll. C. F. C. Beeson.

Type deposited in the Forest Research Institute, Dehra Dun.

Abdomen with appendages 56 mm. Hindwing 53 mm.

Head. Eyes dark olivaceous brown, probably greenish in the living state. labium and labrum bright ochreous, the latter bordered narrowly with dark brown; face greenish yellow, upper surface of frons sky blue, the base narrowly black with a small, triangular projection in the middle line; vesicle greenish; occiput yellow, the surface wrinkled, posterior border slightly concave, simple.

Thorax uniform grass green, beneath violaceous brown.

Legs black, the femora dark reddish brown, hind femora with a row of small closely-set, evenly sized spines and 2 to 3 larger ones at the distal end.

Abdomen very tumid at the base, cylindrical and tapering thereafter, 7, 8 and 9 somewhat dilated. Segments 1 and 2 grass green except at the apical half of the dorsum of the 2nd which is blue, 3rd segment with a small patch of blue at the sides, basad, rest of abdomen dark blackish brown, each segment marked with 3 lateral, dark yellow spots, one basal, one apical and the third subbasal; segment 7 has only 2 of these spots and 8 and 9 only one which is situated apicalward.

Anal appendages very short, spatulate, rounded at the tips, shaped very much like those of *A. petalura.*

Dentigerous plate rounded, coated with minute, black spines, very similar to the plate of *A. guttatus.*

Wings very broad and hyaline, the bases of the hind enfumed in the subcostal space and anal triangle ; stigma pale brown, very long and slender; trigones of forewings with 6 cells, 4 in the hind; nodal index $\frac{8-16}{10-14} \mid \frac{18-7}{13-10}$; membrane black, its extreme base white, very long; 12 cells in the loop ; hypertrigones traversed 3 times in the forewing, 2 in the hind; 5 cubital nervures in the forewing, 4 in the hind; costa yellow.

The species which belongs to the *guttatus* group is very similar to the female of *A. guttatus* but is easily distinguished from all other species by the distinctive character of its anal appendages.

Genus—AMPHIÆSCHNA, SELYS.

Amphiæschna, Selys, Trans. Ent. Soc., Lond., 1871, p. 413; Bull. Acad. Belg. (3) v., p. 737 (1883).

Eyes widely contiguous; frons rounded; occiput small; wings moderately broad and long, reticulation close, stigma small, membrane mediocre, trigones elongate, of 5 to 6 cells, cubital space and hypertrigones traversed several times, basal space traversed, *Rs.* bifurcated well before the level of stigma, 3 to 4 rows of cells between *Rs.* and *Rspl.* Abdomen long and subcylindrical, constricted at the 3rd segment in the male; anal appendages sublanceolate, excavate on the inner border, the inferior appendage short and subtriangular.

Female. Dentigerous plate denticulate, armed with 6 spines.

Type. *A. ampla,* Ramb.

Hab. Southern Asia.

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Amphiæschna beesoni, sp. nov.

1 ♂ Magavi, Inscin, Burma, 38, XI, 21. "Taken at dusk," coll. C. F. C, Beeson.

Type deposited in the Forest Research Institute, Dehra Dun.

Abdomen 46 mm. Hindwing 43 mm. Anal appendages 6 mm.

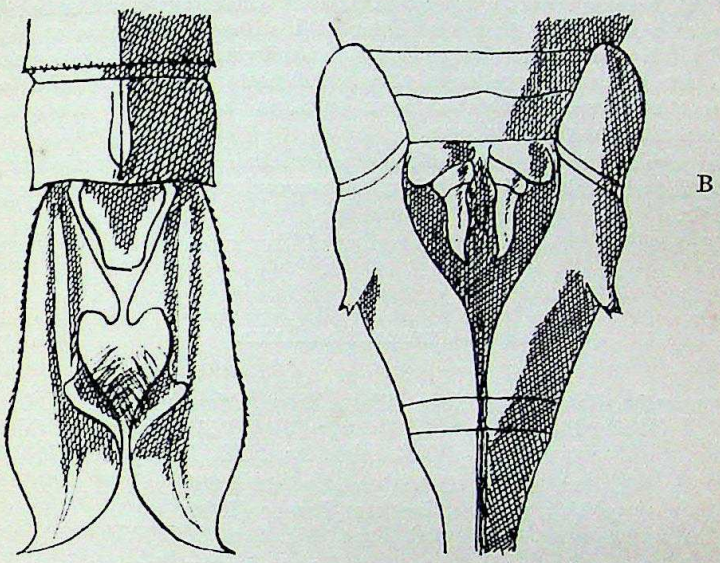

Fig. 1 *A*. Anal appendages and *B*. Genitalia of *Amphiæschna beesoni* (male)

Head globular, eyes dark brown, very broadly contiguous; occiput very small, pale whitish green; labium brownish yellow; labrum, epistome and frons olivaceous, upper surface of latter with a subbasal, black line at its centre, not traversing its whole breadth. Face very narrow.

Thorax dark olivaceous, with bright greenish yellow spots at bases of all wings. No other markings.

Legs reddish brown, the knee-joints darker; hind femora with a row of closely-set, robust spines, gradually lengthening distally.

Wings faintly saffronated, the hind the more so and especially towards its basal half; stigma pale brown, rather small, that of forewing longer than that of hind; forewing 3·5 mm., hindwing 3·0 mm., outer border strongly bevelled, braced, the brace with a slight curve; trigone of forewing with 5-6 cells, the hind similar; a single nervure in the median space in all wings; 7 cubital nervures in forewing, 5 in the hind; 3 cells in anal triangle; nodal index $\frac{12-22}{16-15}\ \frac{22-12}{15-16}$; 8 cells in the loop; *Rs.* forked some way before the stigma, 3 rows between the forking; 3 rows of cells between *Rs.* and *Rspl.* in forewing, 4 in the hind; membrane greyish, almost absent; hypertrigones with 5 nervures in forewing, 4 in the hind; are strongly angulated, sectors arising from its middle.

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Abdomen tumid at base, segment 3 constricted, cylindrical thereafter, the two last segments slightly dilated ; oreillets robust, with 3-4 robust teeth on the free border ; segment 1 olivaceous green as is also the basal half of 2, the apical half of latter sky blue, remaining segments pale olivaceous brown with black, apical rings.

Superior anal appendages very long and highly specialized, considerably longer than the two last abdominal segments, shaped like the blade of a kukri, the edge directed inwards, tapered at base, broad at apex which ends in a sharp, outwardly curved point; inner border with a deep indentation at its middle third and a broad, spine-like projection basal to it. The two indentations, by apposition enclose a large fenestration. Inferior appendage less than one-third the length of superior, blunt at apex, broad at base. Dark olivaceous brown, the inferior paler at its base.

The edge of the indentation of the superior is raised into a prominent rib which is studded with minute, black tubercles from each of which arises a long, brownish hair.

This is the first record of any member of the genus *Amphiœschna* from within Indian limits.

Genus—Gynacantha, Ramb.

Gynacantha, Ramb., Ins. Nevr. (1842) ; Selys, Sagra, Hist. Cuba. Ins., p. 459 (1857) ; Hagen, Neur. N. Amer., p. 31 (1861) ; Kirby, Cat. Odon., p. 94 (1890) ; Martin, Cat. Coll. Selys. fas. XIX, XX, p. 167 (1909).

Acanthagyna, Kirby, Cat. Odon., p. 94 (1890).

Selysyophlebia, Forster, Insekten-Borneo (1904).

Austrogynacantha, Tillyard, Proc. Lin. Soc., N.S.W.V., 33 (1908).

Head large and globular, eyes broadly contiguous, face deep and narrow, occiput very small ; wings long and broad, reticulation very close, trigones elongate, median space entire, submedian and hypertrigones traversed, *Rs.* bifurcated, *Rspl.* widely separated from it so as to enclose 4-7 rows of cells between them, stigma usually rather long, membrane short, narrow or obsolete. Abdomen long and slender, the 3rd segment usually but not always constricted. Legs moderately short, the hind femora usually with a row of gradually lengthening, closely-set spines.

Anal appendages very long and very narrow, sublanceolate, the inferior triangular, shorter than the superior.

Dentigerous plate of female formed by a prolongation of the sides of the 10th segment, on the end of which are two, robust, long spines, separating like the prongs of a hay-fork.

This genus comprises a large group of dull coloured dragonflies, all crepuscular in habits. Their wings are so thickly studded beneath with small spines as to give them a particular velvety feel analagous to a similar condition found in the genera *Zyxomma* and *Tholymis* both of which are also crepuscular in habits. The dull colours are in keeping with their nocturnal habits. Most are insects of large size and none can be said to be small. The female deposits its eggs in dry or damp earth in the dried up beds of watercourses. From these sites the ova are washed down by the first freshet and quickly hatch out. The dentigerous plate is peculiarly fitted for this work, serving to steady the end of the abdomen whilst the ovipositor is driven into the earth between the prongs of the dentigerous fork. In this act the long anal appendages apparently get in the way and are soon fractured off. It is rare to find an old female with entire anal appendages.

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All are northern species except one or two from Ceylon and *G. millardi* which extends widely throughout Southern India.

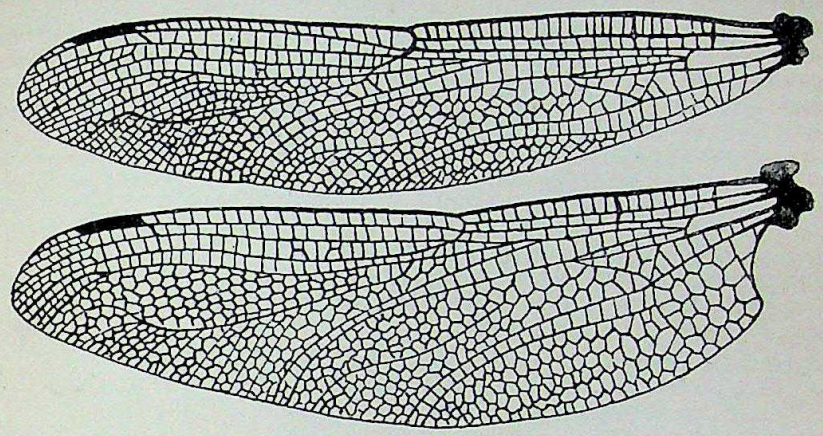

Fig. 2. Wings of *Gynacantha khasiaca*, Maclach. (male).

Gynacantha millardi, Fras, Bombay Nat. Hist. Journ., Vol. XXVII, No. 1, p. 147 (1920); Laid. Rec. Ind. Mus., Vol. XXII, p. 91 (1921).

Male. Abdomen 46 mm. Hindwing 44 mm.

Head. Eyes deep blue in some specimens, olivaceous green in others, very broadly contiguous; in hill specimens the eyes may be a pale dove grey, pale yellow behind and pale greenish yellow below. Face very deep and very narrow, pale olivaceous grey or putty coloured; labium pale yellow as is also the occiput. In specimens from Poona the face, labrum and frons are pale green, the latter being unmarked.

Prothorax and thorax bright foliage green, unmarked but the female sometimes has the dorsum brownish.

Legs brown, or yellowish, the femora with minute spines.

Abdomen pale fawn or darker brown, the sides of the first three segments bright foliage green. Oreillets green or brown. The 2nd segment has a mid-dorsal, transverse streak of yellowish broken at the middle.

The 3rd segment is hardly constricted, thus differing from the majority of the genus.

Wings hyaline, long and broad; stigma pale brown; hypertrigones traversed 3 times; trigones with 6 cells in the forewing, 5 in the hind, 9 to 10 cells in the loop; membrane absent; 7 cubital nervures in the forewing, 6 in the hind; nodal index $\frac{16\text{–}22 \mid 20\text{–}15}{14\text{–}16 \mid 15\text{–}17}$.

Superior anal appendages long and slim, longer than the two last abdominal segments, fringed inwardly with long black hairs, the inner border distinctly sinuous, the outer straight. Inferior appendage not half the length of the superior, turning up, narrowly triangular.

Female almost exactly similar to the male, the abdomen paler, the intersegmental joints and jugal joints outlined in black.

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Dentigerous plate shaped like a hay fork, the two prongs in extension of the produced sides of the 10th segment.

Anal appendages shorter than those of the male and broadening towards the apex internally, reddish brown, the hairs on the inner side not so evident.

Hab. The type and many other specimens were taken in the Empress Gardens, Poona, hiding up under the drooping branches of mango trees or clinging to the inside of green hedges. They took to the wing about dusk and continued flying to long after dark. I have since received specimens from Mr. Hearsey, from Palghat, which do not differ in any way from the Poona examples. Still more recently I have taken the insect and seen it widely scattered throughout the Nilgiris at elevations of over 7,000 ft. At this altitude, being cooler, it appears on the wing at about half past two or three and continues on the wing until about six when it apparently grows too cold for it. I have seen them hovering at about a foot from the ground, in front of deodar hedges around the Ooty lake or describing figures of eight at a few inches from the ground, when they were well nigh invisible. Tropical, crepuscular dragonflies apparently become diurnal in colder climates.

Gynacantha khasiaca, Maclachlan, Ann. Mag. Nat. Hist. (6), p. 429 (1895); Laid. Rec. Ind. Mus., Vol. VIII, p. 340 (1914); Martin, Cat. Coll. Selys, pp. 202-203 (fig. 207), XIX, XX (1909).

Male. Abdomen 54 mm. Hindwing 45 mm.

Head. Eyes very large and broadly contiguous, green, paler below where they have a yellowish tint; occiput yellow; labium and lower part of labrum ochreous, the rest of face olivaceous with a slight ochreous tinting. Above frons a black, T- shaped mark on a greenish background.

Prothorax and thorax bright olivaceous green, the hind, lateral suture brown and a brownish tinting of the dorsum.

Legs black, bases of femora and tibiæ reddish brown. Hind femora with rows of robust, closely-set, gradually lengthening spines.

Wings hyaline or in adults more or less deeply enfumed; stigma light brown, braced, rather large; 5-6 cells in trigones of forewing, 5 in the hind: nodal index $\frac{18-27}{20-19} \mid \frac{25-17}{18-19}$; hypertrigones traversed 7-8 times in the forewing, 5-6 in the hind; loop with 8 cells but its limits very obscure; 7 cubital nervures in the forewing, 6 in the hind; membrane very small, white.

Abdomen very long and slim, tumid at the base, markedly constricted at the base of the 3rd segment, cylindrical and of even width thereafter.

Blackish brown, segment 1 pale on the dorsum, a broad, green spot on the sides, 2 with the dorsal carina narrowly green and a transverse stripe about its middle of the same colour which does not quite meet the green on the carina, apically there is another green patch, whilst the oreillets and the sides are turquoise blue, except for a small spot of green beneath the oreillet, segment 3 has the basal and lateral part turquoise blue, whilst segments 3 to 6 have medial, transverse, greenish marks and yellowish, apical markings on the dorsum.

Anal appendages black, very long and slim, the inferior being about three-fourths the length of the superior. The latter are a little expanded at the apex where they end in a fine, long inwardly curved point.

Female very similar to the male, the appendages shorter.

This species is easily distinguished from all others by the relatively great length of the inferior anal appendage, about-three fourths that of the superior (in no others does it reach more than half the length of the superior). The type is from the Khasia Hills, but it has also been reported from the Abor Country and I have a specimen from Lower Burma. The above description is taken from this

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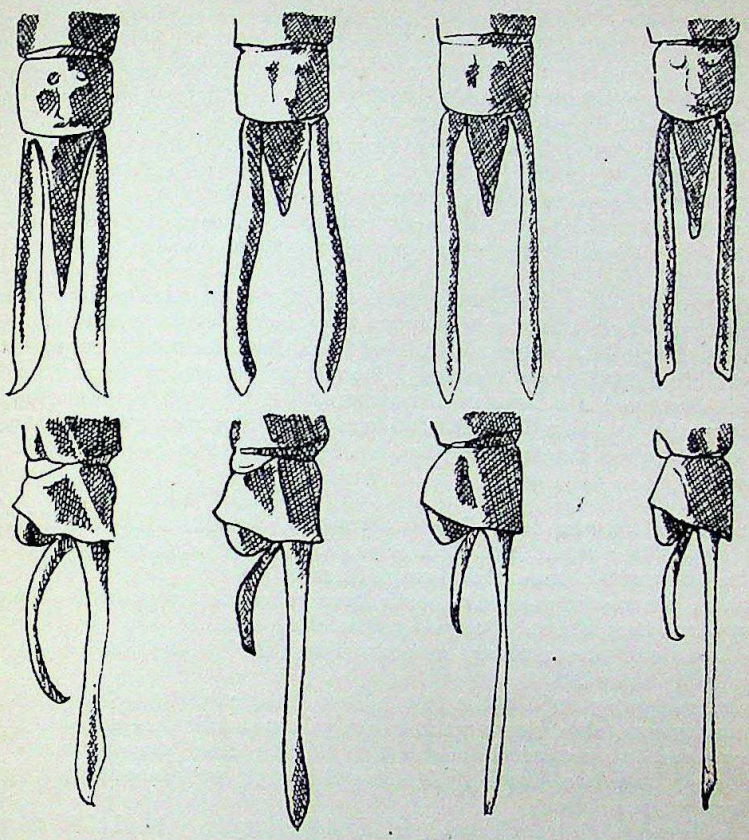
specimen and differs in a few respects from the type but I have no doubt but that it belongs to *khasiaca*.



I II III IV

Fig. 3. Anal appendages of:—1. *G. khasiaca*. 2. *G. furcata*. 3. *G. bayadera*. 4. *G. o'doneli*.

Gynacantha bainbriggei, Fras, Memoirs of Pusa. Vol. VII, Nos. 7 and 8, June 1922.

Male. Abdomen 50 mm. Hindwing 47 mm.

Head. Eyes bluish grey, frons pale brown with an ill-defined, black, T-shaped mark above; lips and face pale brownish yellow, unmarked; occiput yellowish; a fringe of long hairs along the ophthalmic suture.

Prothorax black on the dorsum, brown on the sides.

Thorax pale brown with diffuse, mid-dorsal and humeral blackish fasciæ, each traversed by a dark line. No markings on the sides.

Legs black, the femora brown at the base, sometimes entirely pale brown.

Wings hyaline; stigma pale brown, 3·5 mm. in length; hypertrigones traversed 6-8 times; trigones variable, traversed by 3-5 nervures; loop with 11-13 cells; nodal index $\frac{21\text{–}26 \mid 25\text{–}22}{21\text{–}21 \mid 20\text{–}21}$

Abdomen pale brown marked with shades of grey and black and a pair of sky blue spots on the 2nd to 7th segments. On the 3rd segment are a pair of similarly

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coloured spots at the base. The apical spots are edged apically and outwardly with black, this colour being continued forward subdorsally and tapering away until finally lost in the ground colour.

The last 3 segments black, unmarked. Oreillets large, sky blue above, dark beneath, the posterior border minutely toothed.

Anal appendages very long and very narrow, 7 mm. in length, fringed inwardly with long hairs, inner border slightly sinuous; inferior triangular, narrow, less than half the length of the superior.

Female. Abdomen 53 mm. Hindwing 50 mm.

Almost exactly similar to the male. The wings rather deeply enfumed, usually a dirty brown especially at the apices.

Labrum, labium and face distinctly ochreous. Thorax greenish. Legs a light brown, the hind femora with a row of closely set, gradually lengthening spines.

Dentigerous plate as for genus. Anal appendages long and narrow, but in all specimens which I have seen they are fractured off about half way.

Mr. Bainbrigge Fletcher, who discovered this species, has seen it ovipositing in dry earth, in a dried up water course. Eggs, which he secured from samples of the soil, developed into larvæ in a few hours.

The species was found at Gauhati and most specimens were beaten up from dry bamboo jungle during the day. Ovipositing was seen late in the afternoon.

Gynacantha bayadera, Selys, Odonat. Birmanie, Ann. Mus. Genov., XXX, p. 400 (1891); Martin, Cat. Coll. Selys. XIX, XX, p. 198 (1909).

Male. Abdomen 45 mm. Hindwing 41 mm.

Labium, labrum and face olivaceous; frons yellowish, its crest black but no T-shaped marking above. Occiput yellow, very small.

Prothorax and thorax foliage green, unmarked.

Legs palest brown.

Abdomen slightly tumid at the base, a little constricted at the 3rd segment or this scarcely noticeable, brown marked with yellow as follows:—segment 2 with an annule and two subapical lunules, 3 to 7 with basal annule, two median, linear spots and two terminal lunules; 8 and 9 with longitudinal, yellow markings on the sides.

Wings broad, slightly enfumed, costa yellow; stigma yellowish, of medium size; membrane small, blackish; *Rs.* forked just under the origin of stigma; anal triangle broad and short, with 3 cells; nodal index $\frac{12\text{–}22}{17\text{–}18} \mid \frac{18\text{–}17}{17\text{–}19}$. Base of wings often saffronated.

Anal appendages brown, long and narrow, the superior rather longer than the last two abdominal segments, rather sinuous; inferior rather less than half the length of superior, narrowly triangular.

Female closely similar to the male. Appendages brown, slender at the base long, foliate with slender, rounded ends.

Abdomen 45-47 mm; hindwing 40-41 mm.

Reported from India and Burma (Sikkim, Bhamo). I have not seen examples of this species.

Gynacantha hanumana, Fras., Memoirs of Pusa, Vol. VII, Nos. 7 and 8. p. 76, June 1922.

Male. Abdomen 43 mm. Hindwing 44 mm. Anal appendages 4·5 mm.

Head. Labrum, labium and face palest brown or fawn; frons pale olivaceous marked with a thick, black T-shaped mark above; eyes olivaceous, occiput yellow, very minute.

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Prothorax blackish.

Thorax pale violaceous grey, clouded with sooty grey on the sides, the mid-dorsal carina diffusely black.

Legs pale brown, yellowish, or ochreous ; hind femora with a row of very short spines with some longer ones at the distal end ; tibial spines long and numerous, claw-hooks basal. robust.

Wings hyalline but distinctly enfumed ; loop with 12-13 cells ; stigma 3·7 mm. in the forewing, that of hindwing smaller, whitish brown with dark borders, braced sinuously; 8-10 cubital nervures in the forewing, 7 in the hind ; 6 cells in trigone of forewing, 5-6 in the hind ; nodal index $\frac{19-26 \mid 24-18}{20-19 \mid 19-21}$; hypertrigones traversed 6 times in the forewing, 5-6 in the hind.

Abdomen very long and slender, the 3rd segment constricted at the base, cylindrical thereafter to the anal end, transverse ridges on segments 2-8. Bluey grey in colour, dorsum of segments brownish black, broadly so at the apex, this colour gradually fading basally, the 3rd segment basal to the transverse ridge, pale greyish blue, the oreillets turquoise blue, narrowly margined with black, segments 3 to 7 have also a pair of apical, blue spots.

Anal appendages long, narrow and pointed at the apex, blackish brown, the inferior two fifths the length of the superior, the superior fringed densely with black hairs.

Type in the Pusa collection, taken by Mr. C. M. Inglis at Mangpu, 18-2-20, 5,200 ft, Darjiling Dist.

Gynacantha furcata, Ramb., Ins, Nevr. p. 210 (1842) ; Laid. Rec. Ind. Mus. Vol. XXII, p. 91 (1921); Kirby, Linn. Soc. Journ. Zool. XXIV, p. 558 ; id, Cat. Odonata, p. 95 (1890).

Male. Abdomen 53 mm. Hindwing 45 mm.

Head. Labrum, labium and face greenish yellow ; frons greenish with a black stripe across the crest but no tail converting it into a "T".

Thorax greenish yellow, unmarked.

Legs reddish.

Abdomen tumid at the base, constricted at the 3rd segment, cylindrical thereafter. An oblique, subdorsal, yellow spot on most segments about the middle.

Anal appendages long and slender

Wings hyaline, reticulation open ; stigma broad and yellowish in colour.

Martin's male from Tonkin differs somewhat from this meagre description. The legs are reddish with black articulations. The abdomen is mahogany brown with a greenish spot on the dorsum of the 2nd segment, and 2 median and 2 apical, yellow spots on all segments from 2 to 7.

The superior appendages are brown in the middle, black at base and apex, moderately slender at the base, enlarging towards the apex which is spatulate and pointed. The inner border sinuous. Inferior black, broadly triangular, a little more than one-third the length of the superior.

The wings are enfumed at the base, the anal triangle is broad and short, the nodal index :—18-28/24-20 in forewings.

The female from Tonkin has the face olivaceous, the frons with a well-marked T above, the thorax brown, marked with blackish; other points as for the male.

Martin is inclined to regard this species as a race of *hyalina*.

The male in the Selysian collection has the abdomen 48 mm., hindwing 40 mm. Selys regards it with some doubt. The type male is in the Selysian collection, the paratypes, from Tonkin, in Martin's collection. Kirby has reported it from Ceylon so I include it here, although with some doubt.

Gynacantha saltatrix, Martin, Cat. coll. Selys. Fasc. XIX, XX (fig. 199), pp. 194,195 (1909) ; Laid. Rec. Ind. Mus., Vol. XXII., p. 91 (1921).

Male. Abdomen 42 mm. Hindwing 35 mm.

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Head. Labium, labrum, face and frons pale greenish yellow, the frons marked with a thick, black T above; occiput very small, pale yellow.

Thorax broad, brown above marked with obscure, green, humeral bands, the sides greenish.

Legs pale yellowish brown.

Abdomen tumid at the base, constricted at the 3rd segment, broadening again at the 4th and thereafter tapering to the anal end, reddish brown spotted with green. The 1st segment with a large blue spot at its base, the 2nd with a dorsal and two central green spots and two lateral, apical spots of green, 3 with an oblique, medial line and an apical, slender line of green, 4 to 8 with the medial line and two apical spots, 9 with 2 subapical spots of yellow, 10 reddish, unmarked, bordered with black.

Superior anal appendages longer than segments 9 and 10, slender, of even breadth from base to apex where they are slightly broadened and pointed, fringed internally with black hairs. Inferior about one-third the length of the superior, narrowly triangular, pale yellow with the apex black.

Wings long and broad, hyaline, costa yellow; stigma moderately long and slender, pale brown; membrane nearly obsolete, white; *Rs.* forking a little before the stigma; 5 cells in the trigones; anal triangle with 3 cells; nodal index :— $\left|\frac{15\text{-}21}{17\text{-}15}\right|$.

Closely resembles *bayadera*, differs as follows :—by the well marked "T" on frons, by the tumid basal segments of abdomen, the very large oreillets, the 3rd segment of abdomen very constricted, and by the even sized superior anal appendages. Differs from *subinterrupta* by its smaller size and by the absence of brown spots at the base of the wings.

Type male in Martin's collection. Laidlaw mentions a male from Mazbat, Mangaldai Dist., Assam, collected by Mr. S. Kemp and now in the Indian Museum (abdomen 42, anal appendages 6 mm, hindwing 39 mm.). The type is from Tonkin.

Gynacantha basiguttata, Selys., Ann. Soc. Esp. XXI, p. 20 (1842); Martin, Cat. coll. Selys., XIX, XX, pp. 192-193 (1909); Kruger, Stett. Ent. Zeit. pp. 283-284, (1895); Ris. Ann. Soc. Ent. Belg. LV. pp. 246-247, fig. 13 (1911); Laid. Rec. Ind. Mus., Vol. XXII, p. 91 (1921); Kirby, Cat. Odon. p. 95 (1890).

Male. Abdomen 54 mm. Hindwing 45 mm.

Head. Labium, labrum, face and frons brownish yellow, the latter yellow above marked with a black T; occiput very small, brown.

Thorax brownish, greenish brown or reddish brown, probably greenish during life. Legs all black.

Abdomen very tumid at base, markedly constricted at the 3rd segment and then cylindrical to the end, black marked with yellow as follows :—segment 1 yellowish at the sides, 2 yellowish brown, the carina and a medial transverse line and the apical border black, 3 to 7 with a pair of medial and a pair of apical spots yellow, 8 with the median spots only. Oreillets large.

Wings slightly tinted with brown, sometimes deeply enfumed and with a reddish brown mark at the base extending as far out as the 1st antenodal nervure; stigma brown, very slender; membrane very small, grey; *Rs.* forking just before the stigma, with 7 rows of cells between it and *Rspl*; anal triangle with 3 or rarely 4 cells; tornus very accentuated; nodal index 22-30, 26-23 in forewings.

Superior anal appendages longer than segments 9 and 10, very slender at the base and for the basal three-fourths, then broadening and spatulate, fringed thickly with black hairs on the inner side at the ends.

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Inferior appendages one-fifth the length of superior, brown, black at the end, nearly linear, narrowly triangular at the base.

Female similar to the male, the basal spot of wings more extensive, reaching to the 3rd antenodal nervure. Anal appendages very long and slender, broadening foliately in the second half.

Legs black (or yellow in teneral specimens).

Type in the Selysian collection from the Philippines. Reported from Burma.

Gynacantha subinterrupta, Ramb, Ins. Nevr. p. 212 (1842).

Acanthagyna subinterrupta, Kirby, Cat. Odon. p. 95 (1890); id, Linn. Soc., Journ. Zool., XXIV, p. 558.

Gynacantha subinterrupta, Martin, Cat. coll. Selys, fasc. XIX, XX, p. 193, (1909).

Male. Abdomen 58 mm. Hindwing 45 mm.

Head. Labium, labrum and face olivaceous yellow; frons yellow marked with a thick, black T above; occiput very small, black bordered behind with yellow, slightly notched and ciliated.

Thorax dark yellow or ochreous, rather darker on the dorsum, spotted with blue at the attachments of the wings. The sides yellowish.

Legs reddish yellow.

Abdomen very tumid at the base, markedly constricted at the 3rd segment, then cylindrical and of even width to the anal end. Oreillets large, bordered with 6 to 7 small teeth. Dark reddish brown, the bases of segments paler, each with a basal pair and an apical pair of ochreous spots, segment 1 is yellow at the base, 2 has only 2 median spots of yellow, 10 is red on the dorsum, black at its apical border.

Superior anal appendages long and slender, brown, considerably longer than the combined length of segments 9 and 10, very slender at the base, then dilated inwardly and again narrowing so that the inner border is sinuous; inferior very narrow, triangular, truncate at the apex which is turned up and slightly bifid.

Wings moderately broad, reticulation close, a little reddish at the base; membrane very small, whitish; stigma short, yellowish brown; costa yellow; some basal spots not very evident in the forewings but more marked in the hind between the subcosta and median nervures and submedian and postcosta; *Rs.* forked a little before the level of stigma; anal triangle with 3 cells; tornus rather prominent; nodal index 22-28, 30-22.

Female similar to the male, the abdomen more tumid at the base and the 3rd segment less constricted. Anal appendages long, slender, foliate.

Abdomen 57 mm. Hindwing 52 mm.

Type in the Selysian collection is from Java. Other specimens are from Papua. Hagen reports it from Rhambodda, Ceylon.

Gynacantha o'doneli, Fraser, Journ., Bom. Nat. Hist. Soc., Vol. XXVIII, p. 700, 1922.

Male. Abdomen 41 mm. Hindwing 39 mm. Anal appendages 4 mm.

Head. Labium brownish, labrum, face and epistome yellewish green, very rugose: upper surface of frons dark olivaceous green, unmarked; occiput bright yellow, rather small. Eyes brown but probably blue or green during life.

Prothorax pale fawny, the posterior lobe fringed with a ruff of long, yellowish hair.

Thorax olivaceous brown on the dorsum, greenish yellow on the sides.

Legs palest brown or yellowish, the hind femora with a row of closely set, evenly spaced, short but robust spines.

Wings very ragged, deeply and evenly enfumed with brown; stigma brown; nodal index: $\frac{13-22}{16-14}$ | $\frac{18-13}{15-15}$; trigones with 5 cells; hypertrigones traversed 4

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times; loop with 15-16 cells; 4-5 rows of cells between *Rs* and *Rspl*; membrane absent; anal triangle with 3 cells.

Abdomen olivaceous green and brown, marked with darker brown and black apical rings towards the end of the segments. The 1st and 2nd segments are broadly green on the sides, the oreillets are large and bear 5-6 robust spines on the hinder border.

Superior anal appendages long and slender, the outer border nearly straight, the inner slightly sinuous and coated with long black hairs, the apex bevelled outwards and ending in a small point. Inferior appendage triangular, nearly half the length of the superior, curled up strongly.

The single male specimen of this insect was sent to me by Mr. H. V. O'Donel whom it is named after, from Hasimara Tea Estate, Duars, Bengal.

It bears a close resemblance to *G. millardi* but is very much smaller. The 3rd abdominal segment is also much more constricted and the wings are deeply enfumed. In size it is equivalent to the smallest known *Gynacantha saltatrix* but the relative sizes of abdomen and wings differ, being 42 to 35 mm. in *saltatrix*, to 41 to 39 mm. in *o'donelli*. It differs again by having the upper surface of frons unmarked.

Gynacantha hyalina, Selys. Bull. Acad. Belg. (3) V., p. 19 (1882).

Acanthagyna hyalina, Kirby, Cat. Odon., p. 95 (1890.)

Gynacantha hyalina, Kruger, Stett. Ent. Zeit. p. 275 (1899); Laid. Rec. Ind. Mus., Vol. XXII, p. 90 (1921); Martin. Cat. coll. Selys. fasc. XIX, XX, pp. 198-199. (fig. 203) (1909).

Male. Abdomen 52 mm. Hindwing 42 mm.

Female. Abdomen 56 mm. Hindwing 51 mm.

Male. Head entirely olivaceous, the frons only being marked with a thick, black "T" above.

Prothorax and thorax olivaceous brown in front and on dorsum, olivaceous on the sides, yellow beneath.

Abdomen blackish brown above, reddish beneath. The dorsal carina and articulations black. The 2nd segment bears very large oreillets, rounded behind and furnished with small teeth. The 3rd segment markedly constricted.

Legs slender, reddish brown, the femora darker at the distal ends on the inner side.

Wings hyaline, slightly enfumed and tinted with brown at the extreme base. Reticulation dark reddish, the costa brownish yellow. Stigma yellow, medium size, 0·3 mm, over 4 cells. The hindwing very broad, the membrane rudimentary, pale grey. 18 postnodal nervures and 24 antenodals to the forewing.

Superior anal appendages black, furnished with long hairs on the inner side before the apex, longer than the 9th and 10th abdominal segments together, 5 mm. straight, very slender, nearly cylindrical, a little thickened before the apex which tapers to a sharp point very slightly inclined outwards, Inferior appendage subtriangular, blunt, a little more than one-third the length of the superior.

Female. Similar to the male but the body and legs paler, the abdomen not constricted, the oreillets nearly absent. Stigma 4 mm. in length. Anal appendages broken, shape doubtful.

Hab. Bhamo (June, July and August). Nilgiri Hills from 1,000 to 7,000 ft. This species varies much in size, the adults are often enfumed as regards the wings and the antenodal nervures vary from 24-36 in the forewing. Sylhet, China, Loo-choo, Lucon, Borneo. The species is very similar to *subinterrupta* but there is no basal marking in the hind wings of *hyalina*.

(To be continued).

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THE SNARE OF THE GIANT WOOD SPIDER (*NEPHILA MACULATA*).

BY

CAPTAIN R. W. G. HINGSTON, I. M. S.

(*Continued from page 649 of this Volume.*)

PART II.

THE CONTINUATION OF THE SNARE.

(*With one text figure.*)

I resume the architecture of the *Nephila*. Her radii are in position, or, at least, the frame has been supplied with a system of branching spokes. Now comes the next stage, the construction of the hub. In the snare of the *Araneus* this is a distinct and separate act. The spider winds five turns of a slender filament around and close to the centre anchoring it at every spoke. Its object of course is to strengthen the framework at the point where the radii meet. Now look at the snare of the *Nephila*. We see no sign of any thread just coiled a few times around the centre. There is, in an architectural sense, no trace of a hub.

The next stage deserves more careful notice; it is the construction of the temporary spiral. Remember the mechanism of the *Araneus*. Having completed her radii, she proceeds to lay down four turns of a spiral round about the inner half of her snare. It is but a temporary scaffold. At a later stage in the architecture she cuts it completely away. Compare the architecture of the *Nephila* with this. She does not first complete her radii and then apply herself to the winding of the coil. I see both operations in progress at the same time; first the placing of a few radii, then the laying of a few turns of the spiral, then the resumption of the radii again. The spiral of the *Araneus* consists of about four turns separated widely in the snare. That of the *Nephila* is a much longer and more important structure. I count the turns in the snare under observation. They number forty-four. And it is a more closely wound and widely distributed filament. It is continued from the centre right out to the very rim. Near the centre the turns are very close together; the distance between them being only half an inch. They gradually separate as they proceed to the circumference where they are as much as two inches apart.

Again I have no doubt that the reason of the variation in the mode of architecture is the result of the difference in the size of the snares. Four turns in the inner half will provide a scaffold of sufficient strength for the few radii of a small snare. But this will not satisfy the *Nephila*. She needs a much more elaborate scaffold to support her longer and more numerous spokes. Moreover, the spiral must be more closely wound and spread throughout the whole area of the snare. It is also an excellent provision for the turns to come near together at the centre and at the circumference to lie wide apart. For near the centre the radii approach one another and there require an additional support.

I must now enter a word of explanation with respect to the temporary spiral. I have called it by this name, though I doubt if I am strictly correct. I imagine that it only appears a temporary spiral, while in reality it is something quite distinct. Anyone after witnessing the architecture of the *Araneus* and then passing to that of the *Nephila*, could not but imagine that the two spirals which

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I have compared were essentially of the same kind. Nevertheless in a strict sense I doubt if this would be true. I suspect that what I have called the temporary spiral is in actual reality an immensely extended hub. Just compare a few points of detail. The hub is the first of the different spirals which the *Araneus* applies to her snare. And so is the temporary spiral in the architecture of the *Nephila*, for, as I have before stated, she constructs no real hub. Again, the *Araneus*, when she extends her radii, at the same time manufactures her hub. And this is exactly what the *Nephila* does when she is constructing what appears to be her temporary spiral. But a more important point is this. The temporary spiral in the snare of the *Nephila* is not destroyed at a later stage as always occurs in the ordinary snare. It remains as a part of the architecture to the end. Thus in this point it differs markedly from the temporary spiral of the *Araneus* and agrees more closely with the hub. Indeed it is only for convenience of description that we can speak of it as the "temporary spiral." It appears as such; fulfils that purpose as a scaffold, but close and strict observation reveals that it is in reality more to be compared with the ordinary hub. Considered in this light the snare of the *Nephila* possesses an enormous hub and no temporary spiral at all.

We have now reached the last stage in the architecture, the construction of the viscid spiral. The work bears a close resemblance to that of the *Araneus*; nevertheless it supplies some additional information and differs in some interesting points. The *Nephila*, of course, begins at the circumference and winds her spiral round and round the snare. She draws out a thin transparent line which she affixes to every spoke. It is very delicate, pale yellow in colour, and a powerful light will disclose even to the naked eye that it is beaded with droplets of gum.

Now this laying of the viscid spiral is a very prolonged and tedious work. I have seen the *Nephila* commence her thread at 8-15 p.m. She worked incessantly almost without interruption, and not till 1 a.m., on the following morning did she finally secure the line. How different is this from the *Araneus*. The weaving of her viscid spiral is likewise her slowest and most difficult work; nevertheless she will secure it to a moderate snare in from twenty minutes to half an hour. Elsewhere I have told of certain forms of *Araneus* which destroy their architecture every evening and reconstruct a new one for the night. But such an operation would not suit the *Nephila*. The laying of this spiral is much too tedious to permit of such frequent architecture as this. Her immense sheet must fulfil its purpose for many nights and days.

By means of the application of the viscid spiral the *Nephila* converts her naked spokes into a delicate and close-meshed net. She must travel a considerable distance in the operation; she may circle one hundred and thirty or more times around her great wheel before she has completed the whole. It is at this stage of the architecture that the *Araneus* severs her temporary spiral. As soon as she draws her viscid line across two spokes then she cuts the temporary thread away. Its work as a scaffold is over; consequently it has no further use. Her final spiral is thus very exact, being composed of only a single viscid line. But the *Nephila* acts otherwise; she allows her long temporary spiral to remain. Thus her snare is in a sense less perfect than that of the *Araneus*; there is an intermingling of viscid and non-viscid lines. This results in some confusion and in a loss of symmetry in the architecture. The turns of the two spirals tend to become entangled wherever they happen to meet, and this detracts somewhat from the perfect and symmetrical appearance of the web.

It is worth examining with a little care the more detailed mechanism of this tedious work. How is each long slender limb employed in the slow deliberate circuit round the snare? Here is our opportunity. The little *Araneus* baffles us by her agility and speed, but we can follow the great methodical *Nephila*

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and distinguish each separate act. She takes a position in line with the spokes; her head is directed to the centre; and in this attitude, with great deliberation, she moves sideways round and round her wheel. The *Araneus*, and others of the smaller kind, have to make use of their temporary spiral in order to pass from radius to radius. Between each attachment they have to run inward and cross over by the bridge. Not so the *Nephila*. She is independent of her temporary spiral. She need only reach across from radius to radius and pull herself over the spokes.

Now each of her limbs has its special duty as she moves in the architectural round. Consider that her head is towards the centre, the tip of her abdomen close to her spiral, and that she is making her circle to the left. First look to the legs of the left or advancing side; they are employed in the following way. The fore leg is stretched far out to the left and clutches one of the radii a considerable distance ahead. It is a long and slender limb, and near the circumference I see it grasp a radius as many as eight in advance. This fore limb, therefore, serves as an implement to pull the spider round and round her snare. Now look to the second leg, of course on the same side. It also is stretched out, but the radius which it clutches in its terminal claws is only two in advance. The second leg draws in this radius towards the spider; then it passes the line on to the claws at the tip of the third leg which is stretched out to receive it. In the same way the third leg passes on the line and hooks it over the claws of the hind leg; and the hind leg then continues the traction until it finally anchors the line to the spinnerets. This last effort is a careful and decided pull. At the same time the tip of the abdomen is pressed down with decision upon the radius; the spinnerets touch the line, and the viscid spiral is secured. But there is another detail; the function of the left hind leg is not yet quite complete. Immediately after the attachment has been made, the hind leg then presses away the radius which before it had pulled in, and this has the effect of drawing some of the viscid spiral from the spider's spinnerets.

Now turn to the limbs of the right side. The first three do not perform any work quite so particularly precise. They certainly move with deliberation and care. They are stretched in towards the centre; they clutch the turns of the temporary spiral, but they do not appear to fulfil any more precise function than just to support the spider in her circles round the snare. But it is otherwise in the case of the hind limb of this side. I have just said that the last effort of the left hind leg was to press the radius away from the spinnerets, but, after a short thrust, it then passes over the line to the care of the right hind leg, and this limb continues to press away the radius until sufficient of the filament has been drawn out. One other minute point; the left hind leg works with its claws; the right one thrusts with the joints of its tarsus.

This, so far as I can see, is the rather detailed and complex mechanism of the movement, and it is one in which each leg has its own particular purpose to fulfil. The legs of the left side are mainly organs of traction employed to pull the spider on her course. Moreover the last three serve as a series of implements to pass the radius to its anchorage on the spinnerets. The legs on the opposite side act chiefly as organs of support, but the hind leg possesses the additional function of pressing away the radii so as to extract the sticky line.

We watch the spider. We look with wonder at all this complexity, and we note the precision with which each member performs its particular work. When all of a sudden the *Nephila* halts; she reverses her direction; she has been moving to the left; she changes, and starts on a fresh circle to the right. Now again observe her limbs. Those of the right side take up the duties previously performed by those of the left side. There is no confusion; each assumes its corresponding task, and, without a sign of any hesitation, she reverses the functions of her limbs. Excellent architect; she is ambidextrous in a refined

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and elaborate degree, even in the complexity of delicate movements that enter into the manufacture of this spiral line.

There is still a further point to consider before we leave this portion of the snare. By what mechanism does the *Nephila* measure the even distance between her coils ? She is a skilful geometrician, and she must have some very efficient method of securing the perfect parallelism of her lines. Again I recall the work of the *Araneus*. She is so swift, so agile in all her movements ; she fixes her line so rapidly that it is difficult to observe with minute care the mode of measurement which she adopts. Nevertheless, I found by the aid of experiment that she works on a very simple plan. She converts her fore leg into a measuring rule in order to estimate the distance between the turns. While she is engaged at one turn she stretches out her fore leg until with the extreme tip she touches the turn which she laid down in her last circle. In this way she measures off a certain distance from her last turn and then she affixes her thread. At every point of fixation she makes the same measurement ; thus she ensures that the new line is parallel to the one last laid down.

Let us look now to the slow and leisurely *Nephila*. There is no haste about her grave actions. She will surely tell us something ; she is so decided in everything she does. It is immediately evident that her mode of operation is quite distinct from that of the *Araneus*. At no time does she bring her fore leg so as to touch her viscid spiral ; indeed, I have already shown that these legs are employed in another way. We must look to the hind leg of the *Nephila* in order to discover how the measurement is made.

I fear that I am very tedious, but it is worth observing this geometrical act with a little detail and care. The *Nephila* is circling to the left. Four turns of her viscid spiral are in place, and she is now engaged in anchoring the fifth. I have already explained how the hind leg on the left side receives the radius from the third leg, and then draws the line steadily in until it touches the spinnerets. But let us fix our attention at the very moment of this act. The hind leg receives the radius ; the line is clutched in the terminal claws ; but the essential point to observe is that the claws take hold of the radius at the exact point where it meets the fourth turn of the spiral, that is the turn which has last been laid down. From that point it draws in the radius until the line comes in contact with the spinnerets about one-sixth of an inch away. The spider passes on from radius to radius, and at every anchorage the same mechanism occurs. The tip of the hind leg always takes hold of the radius at the point where it meets the last turn of the spiral. And as the leg is kept bent in the same position an equal distance is thus always measured off. It is the distance from the spinnerets to the tip of the hind leg. Thus each line is the same distance from each preceding line, and a perfect parallelism is secured. It is a very simple mechanism, but it is wonderfully precise. It stamps the *Nephila* as an accurate geometrician that works in a mathematical way.

It is only by some such simple mode of measurement that this excellent result could be obtained. For remember that the *Nephila* is an ungainly creature with slender groping limbs that span over six inches across. Yet with such long and awkward implements see what a marvellous net does she produce. Every line is in perfect parallel, and they are only one-sixth of an inch apart !

By the aid of two experiments I confirm the fact that this is the mode of measurement employed to draw line parallel to line. The first experiment is a mere repetition of one previously made on the snare of the *Araneus*. It fixes the junction of the last turn of the viscid spiral with the radius as the point from which the measurements are made. For if the spider places one turn by estimating the distance from this junction on the preceding turn, then if I remove the preceding turn, I will deprive her of this junction ; I will have taken away her point of measurement, and, as a result, she should fail to draw parallel lines. I perform the experiment ; I remove the turn in one

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segment, and let us now look to the diagram (Fig. 2) and witness what has occurred.

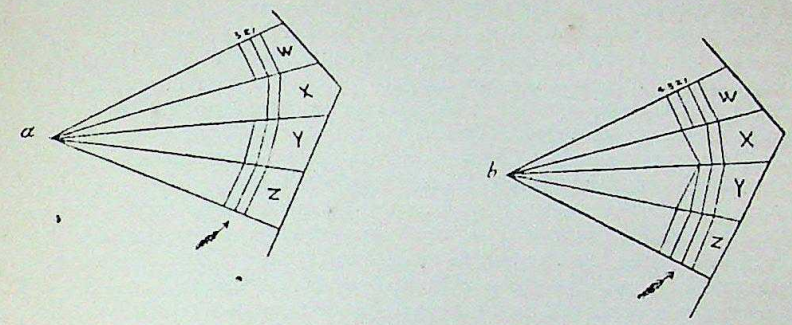

FIG. 2.—Loss of parallelism resulting from division of one turn of viscid spiral in one segment.
(*a*) Viscid spiral divided in segment X.
(*b*) Result of spider's work. Loss of parallelism in both X and Y.
Arrow mark the direction of spider's circle.

Turn first to diagram *a*. Let w, x, y, z be four adjoining segments. Let x be the experimental segment, and let three turns 1, 2, 3 of the viscid spiral be complete. I divide the innermost turn in segment x. Now turn to diagram *b*. The spider circles on laying down the fourth turn of its spiral all round the snare. At length it reaches the radius between z and y. Here all is well. It stretches out its hind leg; it touches the radius between the segments exactly at the point o, that is the point where the radius meets the last turn of the viscid spiral. This point of measurement is intact. Therefore the spider makes an accurate judgment, and draws her line parallel across segment z. She passes on to the radius between x and y. She again stretches out to hook the radius at the point where it meets line 3. But line 3 is gone, therefore she must touch the radius where it meets line 2. Her measurement is consequently incorrect. Her attachment is made in the wrong place, farther out on the radius, and the line drawn across segment y is out of parallel. The spider passes on. She reaches the radius between w and x. She stretches forward; here she finds the line correct, and she anchors her filament in the right place. But the other end of that filament has found a wrong attachment, therefore the line across segment x is also out of parallel. To sum up; the result of the experiment is this. One turn of the viscid spiral is removed from one segment. The point where it touches the radius is as a consequence destroyed. But, since this is the measuring point for the spider, therefore the next turn of her viscid spiral is incorrectly laid. Its parallelism is lost in both the experimental and the preceding segment. In the one the lines converge, in the other they diverge. The essential fact is that the point of measurement being removed then the parallelism is lost. Thus the clear conclusion is that each attachment of the viscid spiral is measured off from that point on the radius where it is touched by the preceding turn.

So much is confirmed; but we have not yet clinched the fact that the hind leg is the measuring rule employed. We must make certain of this observation, since it is directly opposite to the method of the *Araneus* which measures by the aid of her fore leg. I satisfied myself of this by first amputating the legs and then witnessing the result. Let us attempt a similar experiment on the *Nephila*. But in her case it is the hind legs which we must first cut away. It

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is a simple matter to operate on these long limbs, much easier than on the little agile *Araneus*. But we are dealing with a very timid creature and we must be patient in waiting for the result. With a fine pair of scissors I snip off the tips of the two hind legs. The *Nephila* is very concerned. She does not soon return to work as did the mutilated *Araneus ;* she remains at the outskirts of her snare for as long as six hours. At length she does return and again takes up her spiral thread. I watch her movements, and it is clear in a moment that I have anticipated the result aright. It is the same as occurred to the *Araneus* after her fore leg had been removed. The *Nephila*, as a result of the mutilation, is immediately at serious fault. She advances in her slow methodical way. But no longer do the hind legs apply themselves to their task ; no longer do the claws clutch on to the radius ; the amputated tarsi are now held wide apart and tilted behind her clear of the web. Nevertheless she works persistently on ; she climbs across from radius to radius, and, though clearly hampered by the grievous loss, yet she sticks with a dogged determination to the work. Though her organ of measurement is gone, yet her instinct still impels her on, and, correct or incorrect, she must anchor a spiral of some kind to her spokes. Therefore hour after hour she struggles perseveringly on. Though she can no longer measure from her viscid spiral, yet she still has a rough and imperfect guide. She can work along the turns of her temporary spiral ; they will not help her to draw her lines parallel, but at least they will keep her in her circular course She thus looks to her temporay spiral for assistance in her present strait. She applies her third pair of legs to it, and, employing it as a guide, she works round and round her snare. With its help she lays down three or four turns of her viscid spiral, and anchors them in some way to the spokes. Then she passes in to the next circle of her temporary spiral, and, under the guidance of this, she lays down three or four turns more. Thus she advances to the centre employing the circles of her temporary spiral as a number of successive guides. They are certainly of value to her ; they help her to maintain her circular direction ; they prevent the most absolute and complete confusion ; they lend some slight aid to a spiral workmanship, but they cannot supply that delicate adjustment necessary to ensure the parallelism of the lines. It is otherwise ; the viscid spiral is all chaos and confusion. The lines meet one another ; they cross ; they intertangle ; they are anchored here and there and anywhere, and always in the wrong place. Nevertheless she persists ; she struggles on to her last attachment, working for half the night. She secures the final touch in place ; she seals it with her usual care and precision, as though she had completed as harmonious a fabric as ever she had woven before in her life. It is an example of dogged determination, but it is a tangled and disordered work. The turns of the temporary spiral are distinct owing to the parallelism in their successive coils. But the viscid filament is only an endless tangle ; there is no trace of that exquisite and perfect parallelism which is the feature of admiration in the geometrical snare. Why ? The *Nephila* has lost her organ of measurement ; she has been robbed of her geometrical power.

Just one final word of summary in order to contrast the architecture of the *Nephila* with that of a species such as the *Araneus* which constructs an ordinary snare. I will review only the most striking points. The web of the *Araneus* is twelve inches across ; the sheet of the *Nephila* is as tall as a man. The *Araneus* extends about twenty radii ; the *Nephila* spreads out a hundred or more. At each journey the *Araneus* lays a single radius ; the *Nephila* secures a pair. Each spoke of the *Araneus* is a double filament ; the *Nephila* makes a single line. Undivided radii is the system of the *Araneus ;* the *Nephila* prefers branching spokes. By a four-pace interval the *Araneus* measures the distance between her radii ; the *Nephila* secures her interval by measuring from the tip of her hind leg to her spinnerets. At the centre the *Araneus* attaches a little spiral which serves the purpose of a hub ; the *Nephila* has nothing of the kind

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in her architecture unless her temporary spiral be an extended hub. The temporary spiral of the *Araneus* is a wide-open structure; the *Nephila* weaves a close-wound coil. Four turns are enough for the *Araneus*, and they are confined to the inner half of the snare; the *Nephila* makes over forty circles spread from the centre to the rim. The temporary spiral serves the *Araneus* for the purpose of a bridge; the *Nephila* steps from spoke to spoke. In the snare of the *Araneus* it is subsequently destroyed; the *Nephila* retains it permanently to the end. The viscid spiral of the *Araneus* is uniform through the snare; the *Nephila* intermingles it with her temporary coils. The fore leg of the *Araneus* measures the distance between its lines; the *Nephila* makes use of her hind leg to secure a similar end. The architecture of the *Araneus* takes half an hour; the *Nephila* works for half a night.

We have finished. We have watched the *Nephila* through the lonely hours, and we leave her now to take her station in her snare. The long night is over; we even see the first faint streak of dawn. Let us go, satisfied with what we have seen. There are none who would join us in this silent vigil, yet the hours are not altogether lost. We have learnt something of beauty and of wonder from this marvellous geometrical snare.

PART III.

Further Lessons of the Nephila.

I will now consider some further lessons taught us by the architect of this snare. We must take every opportunity to learn from one who is so large and so leisurely at her work.

The first is a matter in respect to her architecture. It concerns what I have elsewhere described as the "reversal of the spiral." It is only on rare occasions that a little spider, such as the *Araneus*, will construct a viscid spiral of one single line continuous from end to end. That is the ideal method, but in actual practice she has to modify the work. If we observe her with reasonable care we will often see the following occur. She is anchoring her viscid spiral; all of a sudden she halts; she seals off the end of her spiral; she turns about and commences a new spiral by circling in the opposite way. Moreover, we will observe that she always adopts this behaviour when the point from where her radii diverge happens not to coincide with the true centre of the web. On those occasions some of the radii happen to be long, others happen to be short. And the reversal, we observe, is a plan of architecture associated with the eccentricity of the snare. Furthermore, we will observe that she so arranges her reverses that their effect is to add additional turns to the long radii, and in this way make up for the eccentric nature of the work.*

The *Nephila* adopts a similar plan. I have found certain of her immense sheets in which the so-called centre was very eccentric. I recall one of over five feet in diameter where the centre was only eight inches from the upper edge. While employed in the architecture of so eccentric a work the *Nephila* must reverse at almost every turn. If she circled in the ordinary way round and round her snare, she would very soon complete her spiral in the short and upper spokes, while the long and lower ones would be almost empty of threads. To prevent this she must repeatedly reverse so as to keep her thread almost confined

* The reversal of the spiral is discussed in detail in "A Naturalist in Himalaya."

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to the long spokes. I watch her in the ingenious work. She is moving across her lower and longer radii anchoring her filament as she goes. She reaches the shorter radii; she reverses; she comes back over her long radii again. Soon she approaches the short radii on the other side of the snare. But she will go no further; again she reverses; again she works back over her long radii fixing her filament to the spokes. Thus she, so to speak, oscillates over her long radii; she largely neglects the upper and shorter ones; only on rare occasions does she make a complete circuit round her snare. So seldom indeed that, in this instance, there were 130 turns of the viscid spiral attached to the lower and longer radii, and only 3 turns to the upper and shorter spokes. Moreover, the *Nephila* employs this mechanism not only when dealing with her viscid spiral, but she introduces the same operation into her temporary spiral too. And as with the viscid filament, she may sometimes do so to an extreme degree. In this same snare, for example, she attached 44 turns of her temporary spiral to the longer, and only 7 to the shorter spokes. Thus she is a spider which works with judgment and system. She can modify her various lines to suit even the most eccentric of eccentric snares.

There is another structure in the architecture of the *Nephila* which I have not observed in ordinary snares. Not only does she spread an extensive sheet, but she also constructs a special barrier in order to drive her victim more surely into the toils. She places it so as to face one surface of her sheet; it is at a slightly higher level than the main snare, and a little distance away. There is nothing precise or geometrical in its workmanship, it is merely a tangled maze of lines. They are powerful filaments; they are non-viscid; they meet at all angles; they are spread about in every direction; they form an entangled barrier through which no insect can pass. It is a strong and impenetrable silken wall, about two feet or more in depth, and secured by an anchorage of powerful cables above, below, and at the sides. In some places its meshes are wide and open, and strange insignificant spiders will then sometimes seek a refuge there. They will spin their own miniature but perfect webs amidst the entanglement of coarser lines.

The object of the barrier is, I think, this. The main snare, though a vast sheet, is in texture rather fragile and thin. It is spread chiefly for the moths and flies that emerge from their concealment by night. It will not secure the larger prey. A locust will tear itself from the viscid grasp and easily break away. Thus without the aid of some additional resource many of the captures would certainly be lost. By means of the barrier this purpose is fulfilled. The victims which break from the main snare strike the entanglement of lines; they cannot advance; they strive to escape, but are only driven back again into the snare.

There is another feature in connection with this snare which it is worth our while to observe. The *Araneus* possesses the remarkable habit of swallowing completely the remains of her architecture as soon as it is worn out. It usually serves for twenty-four hours, after which time it is a tattered web. Then at evening we may see the spider demolishing all that is left. She eats up her successive radii, her viscid attachments, every little tag and shred, and all the tiny insects that happen to be entangled on her lines. In fact she systematically destroys and takes back into her own substance all that remains of her unserviceable snare.

I have little doubt that the *Nephila* behaves in a similar way. Her architecture, of course, lasts a much longer time, and I have not actually seen the final destruction that occurs. But an experiment will indicate with sufficient certainty the manner in which the structure disappears. I sever the strong foundation lines all round an immense sheet. I leave just one attachment to the upper horizontal line. The snare collapses, its elastic sides fall in, its innumerable filaments gather themselves together, and, in the form of a sticky rope, it swings

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like a pendulum in the wind. The *Nephila* is alarmed. She hangs for a while to her foundation-line, but at length she recovers and begins to look to her snare. Her first act is to gather up the tissue that remains. It is completely disordered, massed into a rope, and, of course, beyond any idea of repair. This is how the *Nephila* acts. She climbs down along the sticky rope paying out her filament behind. She must descend slowly and with care, for this is a viscid and a tangled ladder, and it sways in every breeze. At last she reaches the lower end, and there, at the extreme foot of the rope, she makes an attachment with her spinnerets. Immediately she starts to climb up again, and we now witness an occurrence which we have never seen before. We observe that the *Nephila* in her ascent actually pays out no thread. She makes use of the filaments for a very different purpose, she literally employs it as a hauling-line by means of which she drags up the foot of the rope behind her. When she has hauled it up a height equal to about her own length, she makes a second attachment and in this way she converts the lower end of the rope into a coil. Now she makes a second ascent, hauls up her coil, climbs an equal distance, makes a third attachment and thus bends another coil. In this manner, by successive stages, she continues to make her ascent. She gathers up behind her coil upon coil, and finally secures the well-wound rope to her upper horizontal line. There it hangs for a little while waiting for the next step to occur.

What an excellent and ingenious performance is this by which the spider gathers up her rope! As the seaman coils his cable on the ship, so does the *Nephila* wind into a coil the final rope-like fragments of her snare. How simple, yet how human like, are the ways of the *Nephila* and many of the acts she does! It is not alone in the geometrical measurements of her construction, but also in the manner that she gathers together the last and tattered fragments that remain.

We wait for about five minutes when we see the next act begin. The spider returns and pays attention to her sticky coils. With her long legs she compresses them into a smaller bulk; with her palpi she guides the mass into her mouth, and takes it between her ponderous jaws. Then, in this attitude, hanging by her legs to her foundation-line, she commences to devour her snare. It is 10 a.m. when the process of mastication begins. She chews at it, she turns it about, she moistens it all over with her saliva, and moulds it into a roundish lump. It is now a dark yellow globule no larger than her own head; and the huge sheet, five feet in diameter, has been compressed into a firm ball. Apparently it is no easy matter to digest this globule of silk. The *Nephila* is tardy in all her actions, but in this she is slow and tedious in the extreme; the most prolonged of all the operations of her life is the mastication of her own snare. I watch her for hours with the yellow ball fixed between her patient jaws. She digests it with such infinite slowness that it seems scarcely to diminish at all in size. All day long I return at intervals, and I visit her late at night. The globular mass is still there; it has grown much less, but a nodule of half digested substance is still fixed between her jaws. I visit her again the next morning. The nodule has disappeared. A vast and beautiful sheet is now spread from tree to tree. The spider has devoured all her previous architecture; not a particle of it is left, so that nothing has gone waste. She has digested it, absorbed it, assimilated it, and brought it forth again. She has converted into her own substance the texture which I had destroyed, and has rewoven the fabric anew.

Another lesson taught by the *Nephila* is the detailed method by which a spider overcomes its struggling prey. The *Araneus* will show us the main operation, but from the large and leisurely *Nephila* we can learn some further points.

The *Nephila* is in wait at her usual place, in the very centre of the snare. Her legs are spread out all round about her; they touch the radii on every side, and thus she feels the gentlest quiver in any part of her web. An insect all of a sudden falls against the viscid lines. The *Nephila* is immediately on the alert.

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She dashes out with unusual speed, much more rapidly than we should ever expect. She comes down upon her struggling prey; she seizes it in her long forelegs; she draws it towards her and sweeps it into her jaws. She falls first upon the thorax; it is there that she makes the deadly stroke. This is the vital spot, for within lies the nervous centre and into its substance she must strike. She acts like the *Hippasa*, which weaves a non-viscid sheet, or the *Tarantula* of Fabre which digs a tunnel in the soil; she behaves as though she knew the anatomy of her prey; she first pierces the vital and essential point in the whole nervous chain. Nor is it any gentle thrust, for her fangs are sufficiently powerful to penetrate the human skin. I have watched her drive them deep into my finger, and have seen the drops of limpid poison gather round the bleeding wound. The insect has little chance from such a deadly and unerring stroke. At the first thrust the nervous ganglion is reached. The poison is driven in; the victim is struck motionless; it can no longer struggle and beat its wings and injure the precious snare. The spider by her cunning has prevented this, for instant paralysis occurs.

The swift struggle is over, and the insect prey is dead. She now takes it between her palpi, and with her middle pair of legs secures it on either side. In this attitude for about half a minute she holds it tenaciously in her jaws. No doubt she is forcing in her fangs and injecting the poison deep into her prey. Satisfied at length that her capture is overwhelmed, she commences to drag it away. She takes it between the claws of her middle legs, tears it from its viscid attachments to the lines, and transports it to her station at the very centre of the snare. Then comes the next process, the sheathing of the captured prey. She releases her jaws; she thrusts her capture out in front of her, holding it in position between the tips of her middle legs. It also receives an additional support from the palpi on either side. The next act is as follows. The *Nephila* bends in her long hind legs and brings the claws to the tip of her abdomen just behind the spinnerets. She hooks the claws round the projecting line and draws the silk steadily out. But she does not pull forth the ordinary line; she extracts a dense sheaf of many slender threads, and these she slowly carries forward beneath her until they reach the capture held out in front. Then she begins to wind them round her victim. The hind leg of one side first makes a turn; then follows the hind leg of the opposite side, and thus, by their alternate action, coil after coil is wrapped around the prey. Some assistance is given to the operation by the peculiar use of the middle legs. By their efforts the prey itself is rotated; and, since the coiling of the sheaf is in the opposite direction to the twisting of the prey, both actions help towards the same result. At length, after a number of turns, the victim is completely sheathed; it is both closely imprisoned and dead. Then she lowers it a little and with a slender strand of silk anchors it near the centre of the snare.

The capture is made, sheathed and anchored; the *Nephila* now begins to feed. Like every other operation it is a slow and patient act. She commences at the head; she bruises it a little and sucks from it all its juice. She then passes on to the thorax, deals with it in the same manner, and then turns to the soft and succulent abdomen. Into the entrails she thrusts her greedy fangs; all the time they are working, sucking, masticating; but there is little bruising of the victim's skin; her object is to extract the soft internal tissues and suck out the animal juice. At length she finishes; she has eviscerated her victim and nothing but a shrivelled carcass remains. She swathes a few more turns of silk around it and fixes it again to her snare. Occasionally she returns to it, takes it up again and tries to extract a further drop. At last it is completely gutted; nothing is left but a mere husk, a dry and empty shell. This is no further use, so she drops it out of the snare. The little drama is over, and she waits for the next capture to occur.

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It was proved by the ingenious experiments of Fabre why a geometrical spider does not become entangled in its own snare. He discovered in his usual simple way that on the integument of the spider there was an oily film, and that, owing to the presence of this unctious coat, the architect did not adhere to her own lines. It was a simple matter to substantiate this. By means of disulphide of carbon the oily film was dissolved away; and then the spider, like any ordinary substance, adhered to the sticky filaments of the snare. I have had the opportunity of repeating these experiments, and they led me to the same result.

But a point which did not come within the observation of Fabre was how and where this oily film is produced. At first it might naturally be suspected that the oil was some kind of a cutaneous secretion which oozed out from the spider's skin; but when we consider the character and structure of the integument it is difficult to understand from where the secretion could appear. We can scarcely imagine glands in the hard coat of a spider in any way like those in the human skin. But speculation on the matter is needless; the *Nephila* supplies an excellent opportunity of observing the source from where the film is derived.

It occurs in this way. The sun has almost set, and the *Nephila* is hanging suspended from a single line. Her snare has already been cut away, and the hour has not yet come for her to commence the architecture anew. Her legs are stretched out round about her; one, of course, is fixed to the suspension line, and, in this attitude, she hangs stationary in the air. I see her now from time to time act in a very deliberate way. She slowly carries a hind leg forward and carefully inserts the tarsus into her mouth. It is placed lengthways between her jaws, and the palpi secure it on either side. It is held there for a little while; it is thoroughly moistened with a clear secretion, squeezed out, I suppose, from the salivary glands; indeed I can even see a drop of the liquid oozed out between the spider's jaws. The tarsus is then withdrawn; it is carried backward, and, while still wet with the secretion, it is gently stroked over the tip of the abdomen round about the cluster of the spinnerets. I now see another leg brought in the same determined manner to the mouth. It likewise is moistened with secretion, then withdrawn, and then employed as a kind of brush along the full length of one of the opposite limbs. Then another change follows. A third leg is taken to the mouth, and the same procedure occurs. In this behaviour the *Nephila* persists, all the while suspended from a thread. She brings each leg repeatedly and in succession to her mouth, moistens it, extracts it, and then transfers the moisture elsewhere. It is a very slow and methodical operation, an act full of purpose and decision. Now what does it mean, for it is clearly a work of much importance; it is so slow, so persistent, and I see her engaged at it for over an hour?

Its purpose is this. The *Nephila* is smearing her body with oil in order to prevent her sticking to the snare. She will commence the first stages of construction soon; this is the preliminary to the work. Her oil, therefore, is no cutaneous secretion; there are no delicate hair-glands, no minute perforations, that open on the surface of the skin. It is from her salivary glands that she obtains the oil, and she applies it to the various parts of her body by means of her own legs. Now watch again with a little care. There are a few further points to note. She does not smear the secretion everywhere so as to cover her whole body in a film. She shows far greater care and discrimination than this; it is only to certain particular parts that she applies her layer of oil. It is no doubt a precious substance of which she has no profuse supply, she must therefore work with providence and apply it only where required. She pays most attention to her legs. Each tarsus, of course, is oiled in the mouth but she is also very careful to paint the legs throughout their whole length. For this purpose one tarsus is often carried across so as to smear a shank on the opposite side. Another point that gets much attention is the ventral surface of the tip of the

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abdomen in the prominent region of the spinnerets. The palpi are also thoroughly oiled. Each receives its greasy coat by being pushed into the cavity of the mouth, but, in addition, one is often employed as a brush to paint the palp of the opposite side. They also carry the secretion elsewhere; from time to time they apply a little to the outer surface of the great jaws. But, with the exception of these special parts, the legs, the palpi, the jaws, the ventral surface of the abdomen in the vicinity of the spinnerets, I do not see the spider attempt to apply her secretion anywhere else. None is placed on the back of the head; none anywhere on the thorax; none on the front of the under surface of the belly, and the whole of the broad dorsal surface of the abdomen does not receive a single touch. The parts that receive it do so repeatedly and in profusion; the remainder of the body is completely ignored. And there is a very good reason for this. The spider smears only those parts of her body which come in contact with her viscid lines. Her legs of course incessantly touch them as she moves from point to point; the tip of her abdomen must often meet them whenever she affixes a line; the jaws and palpi come down upon then at the moment when she strikes her prey. But the remainder of the surface of her body does not ordinarily touch her lines. She need not smear the surface of her belly, since, owing to the natural curve of her body, it is lifted away from the snare. For the same reason she can neglect the front of her thorax, and, since on all occasions she faces her architecture, she need apply none to the dorsal surface of her abdomen, nor indeed to any part of her back. It is therefore only to the special and essential points that she applies her precious oil.

I put this conclusion to the test by bringing the different parts of the body in contact with the viscid lines. I pulled off a leg and applied it to the spiral, but it did not adhere to the thread. I tried the same with the palpi, and I also applied the under surface of the abdomen in the vicinity of the spinnerets. The result was the same; those parts of the spider showed no indication of sticking to the viscid lines. I then touched them with the back of the thorax, and subsequently with the dorsal surface of the abdomen, and these parts immediately adhered just like an object of any ordinary kind. It is clear, therefore, that the spider applies her film of oil only where it is absolutely required. I have told before of her providence in architecture, and of her strict economy in the use of her valuable silk. We see here a further display of prudence in the frugality with which she applies her oil.

How wonderful must be the nature of the special glands that open near a spider's mouth! At her other extremity there is wonder enough; for we look with amazement at the marvellous spinning-wheel and the work which it brings forth. But in the secretions that escape near the mouth there is something to marvel at too. They must have a powerful digestive function. They no doubt chemically alter the ingested food, and we have seen the slow but efficient manner in which they dissolve the viscid snare. But even more remarkable is the manner in which they give forth oil to prevent their owner sticking in her web. Nor must we forget that hereabouts too are fixed those glands that secrete the deadly poison for the prey. What a collection of strange and subtle fluids gathered in a spider's head! There is juice for digestion, poison for destruction, oil for locomotion, each with its own particular purpose and flowing at its appointed time.

These are the chief of the additional lessons which we learn from the great *Nephila* of the woods. She tells us first how essential is the reversal of the spiral in order to ensure the symmetry of the snare. We had known it in part before; but she shows how it can be carried to an extreme degree, and employed not only in the viscid spiral, but also in the architecture of the temporary spiral too. Her second lesson also relates to her architecture. It discloses an additional feature in the handiwork which we had not before

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observed in the snare. This is the barrier, a complex maze of tangled lines which serves to prevent the escape of the capture by driving it back again into the snare. Her third lesson leaves the construction and deals with the destruction of the work. We have not seen it destroyed in the natural way, but we have observed sufficient to indicate the manner in which the structure must certainly disappear. We have witnessed her ingenuity in gathering up her fragments and her coiling of the suspended rope. We have watched her in the patient and determined manner that she devours every particle that remains. In her fourth lesson we learn the minute details of how she deals with her insect prey. We marvel at her knowledge of the vital point, and at the unerring precision of her stroke. We follow the manipulations by which she sheathes her capture and deprives it of its animal juice. Her last lesson is, I think, the most interesting of all. She instructs us in the origin of the superficial film that prevents her entanglement in her own snare. She informs us that it is no cutaneous secretion, but that she manufactures it in her salivary glands. She displays to us the method by which it is extracted and applied to the essential parts. And finally she leaves us with reflections of wonder at the fluids which she is able to produce.

Excellent *Nephila*. She has supplied us with all that we could wish or hope. She has taught us many a lesson in geometrical architecture, and she has told us other things of interest too.

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DESCRIPTION OF A NEW GOBIOID FISH FROM TUTICORIN.

BY

JAMES HORNELL, DIRECTOR OF FISHERIES, MADRAS, AND HENRY W. FOWLER, OF THE ACADEMY OF NATURAL SCIENCES OF PHILADELPHIA.

Pleurosicya annandalei new species.

Head $2\frac{4}{5}$; depth 4; D. VI-I, 8, 1; A. I, 9, 1; P. 20; V. 1, 4; 26 scales in median lateral series between suprascapula and caudal base; 9 scales transversely between soft dorsal and anal origins; 10 predorsal scales forward nearly to hind eye edge; head width $1\frac{1}{2}$ in its length; head depth at occiput $1\frac{1}{2}$; snout $2\frac{1}{2}$; eye $3\frac{7}{8}$; maxillary 2; interorbital $4\frac{1}{2}$; second dorsal spine $2\frac{1}{1\,6}$; second dorsal ray 2; second anal ray $3\frac{1}{5}$; least depth of caudal peduncle 3; caudal fin $1\frac{3}{4}$; pectoral $1\frac{2}{5}$; length of ventral disk $1\frac{1}{2}$.

Body elongately ovoid in profile, deepest at spinous dorsal origin, well compressed, edges all convex. Caudal peduncle strongly compressed, its least depth half its length.

Head large, well depressed, convex over surface; upper profile slightly convex and little more inclined than lower; cheeks swollen moderately. Snout depressed moderately, convex over surface, broadly obtuse as seen from above, length about $\frac{7}{8}$ its width at front of eye. Eye moderate, hind edge of pupil about midway in length of head and upper edge slightly impinging on upper profile. Mouth large, moderately inclined, jaws about even. Maxillary reaches nearly opposite centre of eye. Lips thick, firm, fleshy. Teeth firmly conic, simple; uniserial in upper jaw, forward each side several enlarged slightly or canine-like, of which posterior largest; band of fine firm teeth in lower jaw, widest all around front of mandible and inside forward pair of canines, though much closer; no teeth on palate. Tongue thick, fleshy, free and emarginate in front. Nostrils well separated, simple, pore-like, close before eye; anterior falls little behind last third in snout; posterior close to front eye edge. Interorbital very slightly concave.

Gill-opening forward opposite hind eye edge, deeply incised over wide isthmus, from which free or with only narrow fold anteriorly. Gill-rakers 2 + 6 short rounded tubercles, greatly less than gill-filaments, which are about length of eye. Branchiostegals 5, with third quite divergent from fourth and fifth, these closely shielded along opercular apparatus.

Scales large, firmly adherent, in even longitudinal rows on trunk; absent from most of head, though above extend forward to each eye, leaving median triangular post-interorbital region and line of demarcation to occiput, scales not passing over; breast, pectoral base and fins naked, except slight area on caudal base; 2 median conspicuous interorbital pores, also one behind each posterior nostril with series of papillæ extending forward from each just above front nostril; two large pores behind each eye, from hind pore row of papillæ extends along upper edge of opercle; row of papillæ along front edge of opercle, with median intersecting branch backward; two close-set parallel rows of papillæ along preopercle edge, below extending along lower face of each mandibular ramus; from below front nostril row of papillæ extends down along preorbital edge and then back across cheek; scales with 14 to 17 basal radiating striæ; apical denticles 35 to 38 and circuli rather coarse.

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Origin of spinous dorsal little behind that of pectoral, front spines little curved, though third spine as depressed extends back as nearly as far as last. Soft dorsal inserted about midway between hind eye edge and caudal base, front rays highest. Anal like soft dorsal, origin slightly behind that of soft dorsal. Caudal small, rounded. Pectoral large, broad, rounded. Ventral disk nearly third wider than long, rays all greatly branched and spines each with several flat cutaneous flaps in front. Vent close before anal, with slight papilla.

Colour in life pink over entire body; in alcohol faded pale brownish. Under a lens the alcohol specimen shows dull brownish dots dusted in small patch on cheeks and along side medianly. Fins all uniformly pale to whitish. Iris whitish, with greyish tinge above.

Length 34 mm.

Type, No. 51,094, Academy of Natural Sciences of Philadelphia. Locality, Tuticorin, India.

This interesting little fish is found commensal with the Alcyonarian *Solenocaulon tortuosum* Gray, in company with certain Alpheids and other crustaceans.* We are unaware that the commensal habit has been noted in the other species of the genus, *Pleurosicya boldinghi* Weber, obtained off Western New Guinea. The latter differs at once in the much higher soft dorsal and in the fin formulæ. Weber's examples were smaller, 22 to 31 mm. long, and were dredged at a depth of 32 meters; ours came from 14 to 16 meters, sandy bottom.

(Named after Dr. Nelson Annandale, in slight recognition of his work on Indian fishes.)

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* For details of the commensalism of this fish and the associated crustaceans with Solenocaulon, see page 929 of this Journal.

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SOME COMMENSALS OF INDIAN ALCYONARIANS AND CRABS.

By

James Hornell, F.L.S., F.R.A.I.

(*With 6 text figures.*)

No group of marine animals is more prone than the Alcyonarians to harbour uninvited guests, often of very varied zoological standing. Indian Alcyonarians or 'Soft Corals' as we may dub them in common parlance, are exceedingly variable in form, ranging from the brick red Sea-whip, *Juncella juncea*, through the great assemblage of the Sea-fans, the Gorgonids proper, to the massive Sea-cauliflowers of which *Spongodes* is the type; besides these are the Sea-pens—the thin starved rods of *Virgularia*, the pinnate fleshy *Pennatula*, typical of the group, and the great soft obese *Cavernularia* that lives gregarious in muddy sand.

Those that are greatly branched, offer the best shelter to small animals looking for safe hiding places and so it happens that Spongodes and its near relatives harbour a greater variety of commensals* than any other marine organism.

The Commensals of Spongodes.—The common form of Spongodes met with in Indian seas lives from low tide level (Gulf of Kutch) to depths of about 10 fathoms. It is particularly common in 5 to 8 fathoms in the Pearl Bank region of the Gulf of Mannar; the dredge and the divers bring it up in dozens when the right spot, fairly clean sandy ground, is met with. The term sea-cauliflower which, for want of any accepted English name, is what I propose to call it, gives an accurate idea of the general appearance of a well-grown typical colony, if we imagine all the outer leaves torn away and the terminal florets tinted some bright colour from yellow and orange to pink and dark lake. Each colony has a short massive stalk or rather trunk, giving off numerous branches which divide and subdivide till the terminal branchlets are reached, on which are set innumerable little polyps, white or lemon tinted, each protected by a collar of defensive coloured spicules. The whole is rooted in the sand by means of many sand-encrusted 'rootlets'. The substance of the trunk and branches is permeated by a system of numerous wide canals and by means either of flooding or partially draining these by the action of a net-work of fine muscles fibres, the colony is capable of assuming very different forms; it may expand freely, spreading wide and loosely its many branches—its normal condition—or it may retract into a compact nearly solid mass if irritated, with every gradation between the two extremes. Preserved specimens exhibit many of these gradations, dependent upon the method of killing and the time that has elapsed between capture and preservation. This, in conjunction with the natural great variability of the common species, has landed systematists in difficulties. On the one hand we have lists of 80 or more species, and on the other, the opinion of such an able zoologist as Prof. Sydney J. Hickson, that possibly there is only one true species to which all the 80 may be referred.

The commonest form of Spongodes on our pearl banks is one where the terminal branchlets are suffused some tint of red, usually a warm dark pink, the trunk (excepting the base which is dirty grey) and the main branches being white. This form approaches most closely to the species (? varieties) described by Prof. J. A. Thompson under the names *Spongodes bicolor* and *S. pulchra*.

If specimens of this species be examined as soon as they are brought up by the dredge or by divers, a host of symbiotic animals can be located hiding among

* To be strictly accurate, I ought to say symbiotic organisms, for the term commensals should be restricted to animals that live together in partnership and share the same table. But in this paper I use it in a somewhat loose way as a convenient word to cover all animals that lodge with another and are not definitely parasitic.

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the branches; the list includes at least a couple of brittle-stars, several crustaceans including a galatheid, a porcelain-crab, a clicking prawn, a colourless compound ascidian and a tiny little cowry. A sipunculid worm is often present among the anchoring rootlets, while last and most interesting is one of the velvet-crabs, belonging to the family *Dromiidæ*.

Omitting the last two, the others with the one exception of the alpheid, have the body ordinarily speckled, spotted or mottled with some tint of red.

The most numerous of these uninvited guests is the little porcelain-crab, *Porcellana quadrilobata*. Several of these are usually met with in each colony, the younger and smaller either colourless (white) or faintly speckled with red, while the larger generally have the carapace well mottled with pink. Both colourations are protective as the white ones harmonize with the colour of the trunk and branches, while the pink-mottled are easily lost to sight amongst the pinktipped branchlets. The graceful Galatheid, *Polyonyx biunguiculatus*, is also sometimes found, its upper surface mottled reddish brown. The Ophiuroid and the Cowry are still more distinctively blotched with red, and both seem to be consistently associated with this particular species of Spongodes for I have never seen them elsewhere. They are not however always present and they seem local in occurrence. For example, out of 14 spongodes examined on one occasion on the Ceylon banks, 10 had this ophiuroid, while of 12 examined a few days later from the same depth of water (5 to 6 fathoms) but from a locality a few miles distant, in no case was this ophiuroid seen. It is a smooth-armed species of fair size; the disc measures 10mm. across, the arms 3½ to 4½ inches in length. It lies securely lodged among the branches, the long arms twining ivy-like in and out among them. In colour it is whitish, with five groups of pinkish red blotches on the aboral surface of the disc, and with band-like splashes of the same colour at regular intervals on the upper surface of the arms. The under surface is uniformly white. The upper surface of the arms is actually in no place quite without red pigment; tiny points of red occur over the whole surface, but at fairly evenly spaced intervals they are greatly increased in number and this massing gives rise to the appearance so characteristic of this species of having the arms regularly banded with pinkish red. In some individuals the general pigmentation is much more intense than in others but it can be made out in all when they are carefully examined. When moving about over the host's branches this scheme of colouring harmonizes effectively with the pink and white of the terminal polyp-bearing twigs.

The last of the commensal crustaceans, the clicking-prawn, *Synalpheus gravieri*, never exhibits any red spotting. This is no disadvantage to it, for it is too large, active and pugnacious to fear any animal that is small enough or brave enough to penetrate within the spicule-beset branches of the host. In any case its pale white tint does agree with that of the inner recesses of Spongodes.

Then there is the tiny little spotted Cowry (*Cypraea*). It lives among the outer branches where there is a good deal of mottled reddish colouring. Its mantle, normally reflected over the whole of the shell, is accordingly spotted red, harmonizing exactly with the red and white mottling of its host. The shell itself is marked with a few large brown blotches, quite different from the numerous small red spots on the mantle; as the latter enwraps the shell completely, the colouring shown to the world of its enemies is that of the mantle.

Normally the trunk of this species of Spongodes is entire and solid looking, but a considerable proportion of large-sized individuals from one particular area of the Ceylon Pearl Banks, namely the sandy ground to the east of the Cheval Pār and around the Moderagam Pārs, where it is particularly abundant, have either deep pockets in the upper part of the trunk, or have wide tubes passing down this main axis. These cavities do not communicate in any way with the intrinsic canal system of the Alcyonarian. In many instances the open central

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tube passes completely to the base of the colony, with an opening to the sand beneath, situated more or less centrally among the "rootlets". The upper end communicates with the exterior usually by a simple wide opening, occasionally by two. Such apertures occur on the side of the trunk towards its summit, well concealed by the bases of the main branches which spring from this region.

When the Spongodes colonies have lain about for some time after collection, the 'pockets' and tubes are found empty; when examined immediately the divers bring them up, a small rounded crab, a *Dromia*, an inch to an inch and a half across the carapace, covered with a velvety coating of short golden brown hairs, is found lodging in many—not in all, for this Dromia can be active at times when danger is apprehended and in the cases where his tube has an opening to the sand beneath, he sometimes has time to slip down and shake himself free of the colony as this is being drawn by the diver from its attachment in the sand. His smooth velvet coat facilitates this escape through the lower opening of the burrow. One Dromia only is found in each Spongodes colony. Fragments of Spongodes branchlets, bearing polyps and having every appearance of having been nipped off recently, are frequently present in the tubular burrow, giving rise to the inference that Dromia uses his host's body not only as a dwelling place, but also as a constantly renewed larder; in such case the intruder comes really within the definition of parasite rather than commensal. Very often the walls of the tubular pocket or tube wherein the crab lives, is tinted a distinct red. At first I took this for a development of red spicules in the walls, due perhaps to special irritation, but closer examination proved it to be owing to the presence of more or less broken spicules lying loose in a mucous layer on the inner surface of the tube. It is probable then that these broken spicules are detritus from the food consumed by the crab. Quite frequently the scars where branchlets have been nipped off, can be seen on the surface of these crab-frequented Spongodes.

As showing the great frequency of this peculiar association, on one day out of twelve Spongodes colonies obtained from the Kallatidal Pār (Ceylon Pearl Banks) from a depth of 5 to 5½ fathoms, five contained these symbiotic crabs, lodged in tubular cavities excavated in the trunk. In three instances the cavity went right through the base and opened among the rootlets. In the other two it went far down the trunk, but did not perforate the base. The upper aperture of the tube was usually close to the summit of the main axis but to one side; in one case two apertures were present close to the top, while in another the opening was only about half way up the trunk. My observations convince me that these cavities are induced by the crab, but whether they are formed by the crab forcing its way in by continued and persistent pressure or whether they are produced by the tissues of the *Spongodes* colony gradually growing upwards and around the crab, we cannot as yet say. It is a well-known habit of many species of Dromia to detach fragments of sponges and compound ascidians from their original attachment, and to hold the fragment over the carapace with the aid of the specially modified hinder thoracic legs until such time as the fragment has grown and shaped itself on the under side, exactly to the convexity of the crab's carapace. How this habit has been modified in the case of Spongodes has yet to be discovered but I am inclined to think that the association is formed early in the life of both organisms, and that from a small depression in which the crab first lodged for safety, the subsequent change to a long wide tube is due to the continued presence of the crab necessitating the axis to grow upwards as a hollow cylinder instead of a solid one. I do not consider it to be a gall-like growth but merely an aperture in the tissues kept open by the mechanical presence, not necessarily causing irritation, of the intruding crustacean. Possibly however the crab may help mechanically in the formation of the burrow by pinching and pulling the tissues.

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In species of Spongodes of more lax growth such as *S. dendrophyta*, where the stem is markedly elongated, I have never found Dromia present. The habit of such species would appear to make it less fitted for concealment than in *Spongodes pulchra*; the association also appears local in its range, for while common over a considerable area off the Ceylon coast in the pearl bank region, I have never found it to occur on the Indian side, where the same species of Spongodes is equally abundant.

The Commensals of Solenocaulon tortuosum, Gray.—This species is common in depths of 8 to 9 fathoms on certain coarse sandy ground off Tuticorin, particularly in the vicinity of the pearl bank known as the Melonbadu Pār. It is perhaps the most handsome of Indian Alcyonarians, consisting of a strong stalk rooted at its base in the sand, the projecting part a foot and even more in length, the whole suffused with shades of pinkish red. Frequently the stalk, at a height of a few inches above the ground, divides into two main branches, broad and foliaceous in appearance, giving off again secondary branches even more foliaceous, which in turn give off numerous stout terminal branchlets, bearing most elegant yellow tinted polyps. The stalk except at the base is usually tubular, as are also usually the primary branches. The secondary branches may be either tubular or merely grooved. Variation in form is however extreme and all possible modifications may be met with both in branching and in the extent of tubulation. In some, the tubular character is even restricted to the stalk; in others it extends only into the primary branches, the remainder being grooved in varying degree from a slight inturning of the margin to a deep semi-circular gutter. On account of this great variation Prof. S. J. Hickson* united all the previously described species into one, and I consider he is correct in this attitude. He was also the first to put forward the theory that the origin of the tubulation of the stalk and branches is due to the constant irritation caused to the tissues by the running backwards and forwards of symbiotic crustaceans belonging to the genus *Alpheus*. Hickson notices the presence of these little prawns in the tubular portions of many of the preserved specimens from the Maldives which came under his examination. He hazarded the suggestion that the tubular character of *Solenocaulon* is "of the nature of a gall produced by an active crustacean and that the degree to which it affects the secondary and tertiary branches depends, not upon any inherent specific character of the *Solenocaulon*, but upon the number or activity of the symbiotic crustacea." He instanced the well-known fact that in such corals as *Pocillopora*, *Seriatopora*, and *Millepora*, which often harbour a symbiotic crab, its presence affects growth at the place where it settles and there induces the formation of a spherical or oval gall, "the margins of the affected part being hypertrophied and growing round and enclosing the animal that causes the irritation"; analogous gall-like growths are produced on the branches of various corals and gorgonids by the settlement thereon of various species of cirripedes, whose presence causes a local disturbance of normal growth. He pointed out also how the hypertrophied surfaces in such cases show a smoothness of surface, and in Millepora, an absence of polyps of the same character as is exhibited by the grooved surfaces of the branches and terminal twigs of Solenocaulon. The new evidence which I have adduced above showing how similar and even greater tubes are formed in the related genus of *Spongodes*, goes far to prove the validity of his main inference. My observations show however that other animals live symbiotic lives with Solenocaulon, besides the Alpheid mentioned by Hickson. The principal of these comprise an Anomurid, a Porcelain-crab and, most interesting of all, a tiny Gobioid fish of an hitherto undescribed species of the genus *Pleurosicya*.

* "The Alcyonaria of the Maldives" in *The Fauna and Geography of the Maldive and Laccadive Archipelagoes*, Vol. II, Pt. II, Cambridge, 1903.

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The Alpheid, which clicks loudly when disturbed, is pale in colour and lives Diogenes-like in the tubular portions of the host, which are usually white-walled within, so that the colourless alpheid is indistinguishable when lying in wait in his lair for any small animals that may be tempted to enter for shelter. The little fish also uses the tubular region as a permanent home. In colour it is suffused pink over the whole body. It appears to lead a much freer life than its companion, the Alpheid, issuing forth to search for food frequently, but ready to retreat to his burrow on the least sign of danger.

The other two of the usual commensals living with *Solenocaulon*, do not seem to make any particular use of the hollow and grooved branches though doubtless they do derive some protective benefit from these facilities for hiding. They are however generally found crawling over the branchlets and among the polyps with which their colour assimilates perfectly.

Hickson suggests that grooving and tubulation are due to the irritation of the tissues consequent upon the constant running to and fro of the Alpheid. I am inclined to think that the irritation is more direct and specific; whether the nippers of the big chela have anything to do with it, say by pinching, is worth consideration when some one with the needful opportunity turns attention to this problem.

Commensals of Gorgonids.—Gorgonids of many species are abundant on rocky and stony ground everywhere in shallow water round the Indian

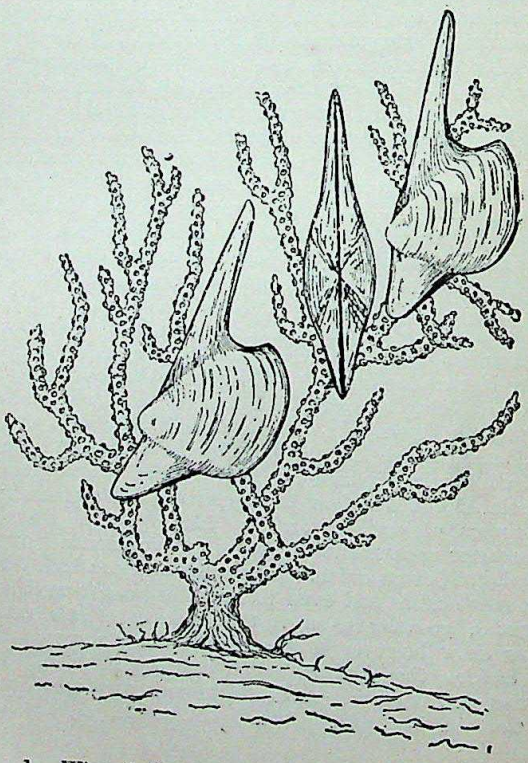

Fig. 1.—Wing-shells (*Avicula radiata*) commensal with a sea-fan. (Original).

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coasts. In the Gulf of Mannar on rough bottom these sea-fans and sea-whips are particularly characteristic. Unlike Spongodes their surface texture is hard and coriaceous, and as their branching is usually in one plane, they do not afford such excellent hiding places to those small animals that elect to live as commensals. But as they are well defended from attack by their hardness and spicular texture, a number of animals nevertheless do seek protection by association with them. These are much better known to zoologists than those of Spongodes and Solenocaulon; it has long been noted, for instance by Thurston*, that delicate Ophiuroids commonly cling in numbers to the branches of the larger Gorgonids, while the beautiful little Cypræid, *Ovula* (*Radius*) *formosa*, is sometimes found crawling along the branches and mimicing their colour exactly, whether red or yellowish-brown. Aviculids (*A. radiata*) have also been noted, settled on several species of sea-fans, their narrow elongated shells oriented in such way that, at least when young, they blend in shape with the branches and so escape detection; they usually settle on colonies of brownish tint similar to their own. (Fig. 1.)

All these I have frequently met with on Gorgonids on both sides of the Gulf of Mannar, together with several other less common or conspicuous commensals. Tiny Ophiuroids are by far the most plentiful. On one great specimen of *Leptogorgia austaliensis* having a spread of 6¾ in. in height by 11 inches in width, I counted 952 individuals, and on two smaller ones from the same locality (north end of the Periya Pār, Ceylon), 159 and 109 were noted respectively. I had understood from previous writers that these Ophiuroids followed the common commensal rule of assimilating in colour to that of their host. My actual experience showed a noteworthy discrepancy. Taking the three specimens above noted, all of dark claret colour, two colour varieties of the ophiuroid were represented, one claret-coloured, the other orange. The former however predominated; of the 952 on the largest Gorgonid, 622 were of this hue, while 330 only were orange; upon the second, 85 were claret, 74 orange, while those on the third were divided into 69 claret and 40 orange. All the Gorgonid trees taken at this particular place were claret coloured. On another occasion, on the outer Vangali Pār (Ceylon) in depths of 7¼ to 9 fathoms, the same species was found in remarkable abundance, over 250 colonies being obtained in one morning; the great majority were claret coloured as in the previous case but a few were orange-coloured. All colonies, irrespective of colour, were infested heavily with the same little Ophiotrix which again showed the same two colour varieties. Whether on the orange or the claret coloured Gorgonids, the majority of the ophiuroids were of the latter colour. Correlated with this we must note that by far the greater number of this Gorgonid (*Leptogorgia australensis*) are claret coloured; only a small minority are orange. But the same ophiuroid is also found on other species and on none more commonly than on *Lophogorgia lutkeni*. Now this species is characteristically and consistently orange in colour and wherever I have found it bearing these ophiuroid commensals, the latter have all been of the yellow variety. The occurrence of the yellow form only on the orange coloured *Lophogorgia lutkeni*, whereas both colour varieties are found commingled on *Leptogorgia australiensis*, which is predominently claret coloured and only rarely yellow, suggests that the yellow variety is the original colour of the Ophiuroid and that the claret coloured ones represent a variety in process of colour evolution with a view to adaptation to the tint of the claret-hued (and predominant) variety of *L. australiensis*. The colour has not yet become stabilized, seeing that a large proportion, roughly 35 per cent., are still yellow among those seen on the Gorgonids of claret tint. As the orange

* Thurston E. "Littoral Fauna of the Gulf of Manaar", *Madras Government Museum Bulletin*, No. 3, Madras, 1895, page 104.

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ophiuroids are extremely conspicuous on such hosts, these must tend to be picked off by those animals that feed upon them; this must give such an advantage to those strains that produce a majority of dark coloured offspring that there can be little doubt that here we have a distinct variety in the making, whereby a strain will be formed producing none but dark coloured young to live on a similarly coloured host.

Masking among Indian Crabs.

The habit of certain crabs to seek safety by masking their body with weeds and sponges and other organisms is well known; the spider-crabs of the family Maiidæ, the velvet crabs (Dromiidæ), and the various species of the sand-crab *Dorippe*, are those that have developed this habit to its greatest extent. They adopt two principal methods; the first, employed by the spider-crabs, is by trimming the carapace and often the larger legs, with fragments of seaweeds, sponges, zoophytes or ascidians, which are held in position by being hooked on recurved hairs developed for this purpose, and not found on any other kind of crab. The surface of the carapace in these crabs is very rough, usually raised into numerous low conical tubercles; these assist in heightening the disguise and in one case, where I had a number of the large English *Maia squinado* in confinement (Jersey) in a tank bereft of seaweeds, the crabs in lieu of anything better adapted to the purpose, selected suitable pebbles and balanced them carefully among these tubercles. The second method, that of the various genera of the Dromiidæ and Dorippidæ, is to hold either a mass of some unattractive sessile animal or a flattened shell over the back as a concealing cloak; to this end the hinder legs, either one or two pairs, are employed, and specially modified both in jointing and in the form of the terminal joint. This last in these crabs is sharp and exactly suits its purpose of being hooked into the substance of the concealing sponge or ascidian in the case of the Dromiidæ; in the Dorippidæ the two last joints are still further modified so that they form a fairly perfect hook, peculiarly well adapted to grasp the thin edge of a shell held aloft over the body. (Figs. 2 and 5).

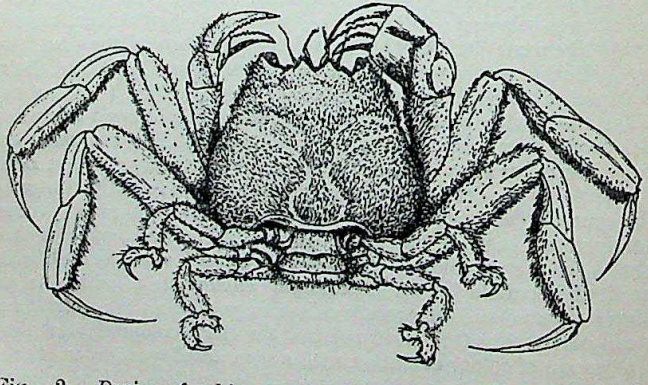

Fig. 2.—*Dorippe facchino* stripped of its masking organism, to show the two pairs of specialized thoracic limbs with their terminal hooked joints. (Original.)

In the weedy shallows of Palk Bay, a small stoutly built spider-crab, *Halimus* sp., is fairly common. After the manner of its kind it usually decorates its

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shell with fragments of seaweed, but occasionally I have met with individuals that have improved on this, by camouflaging the carapace and limbs with many worm-like Synaptids, striped very distinctively purple and white (*Synapta striata*). These live normally as commensals with certain rough-surfaced sponges; it is evident that the crab picks these off the sponge and transfers them to its own back and limbs. (Fig. 3.) The drawing given has been made from a preserved

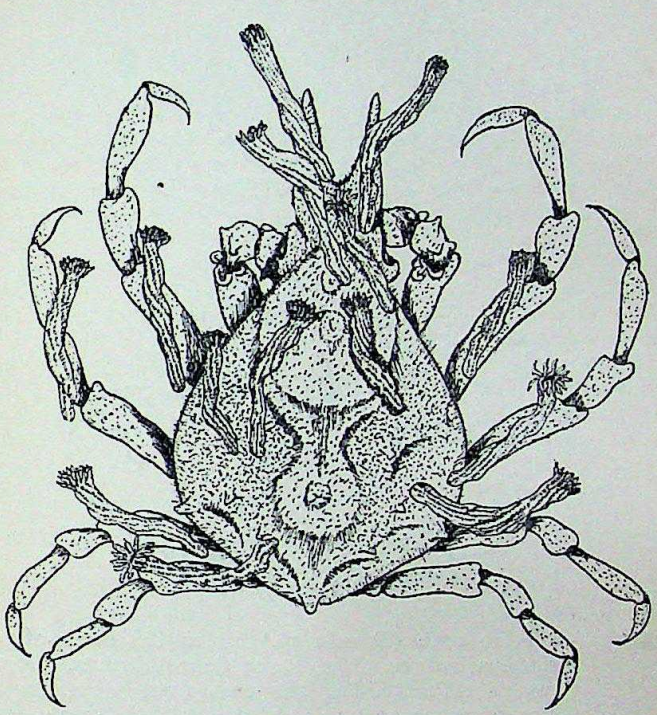

Fig. 3.—A Spider-crab (*Halimus*) from Palk Bay that has decorated its carapace and limbs with striped Synaptids for protection. (Original.)

specimen, after several synaptæ had been removed, but even so, it shows how symmetrically the synaptæ are arranged, and particularly the way in which each leg of the crab has its own synapta, arranged so as to conceal it effectually. In addition to concealing the crab, the synaptæ give it protection through their warning colouration; their skin is full of tiny calcareous spicules of which many are in the form of 'anchors', the points (flukes) projecting, so that if touched the synapta adheres like a burr and is not easily shaken off.

Except in regard to the association of one species of Dromia with Spongodes as above detailed, I have little to add to what is known of the masking habits of the velvet-crabs. Most usually a massive silicious sponge is used to hide the body, as shown in figure 4. In this case the sponge has been so long held in position, that its growth has gone on to such an extent that it fits the body of the crab like a glove, indeed the crab appears to be occupying merely a cavity scooped out in the underside of a massive ball of sponge. Less frequently an ascidian colony is utilized and on one occasion I noted that the concealing cloak carried by a tiny Dromia, only a quarter of an inch across the carapace,

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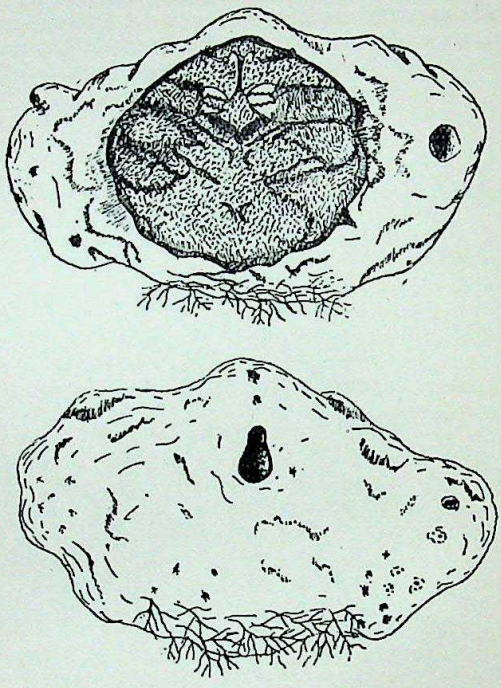
was a ramifying mass of the fine branches of the calcareous sponge *Leucosolenia* greenish yellow in colour.



Fi4. 4.—A Velvet-crab (*Dromia* sp.) under the mask of a stout silicious sponge. The lower figure depicts, the sponge mantle entirely hiding the crab from view the upper one shows the under side of the pair, the crab esconced in a deep hollow in the mass of the sponge. (Original).

At least two species of *Dorippe* are common on the Madras east coast,

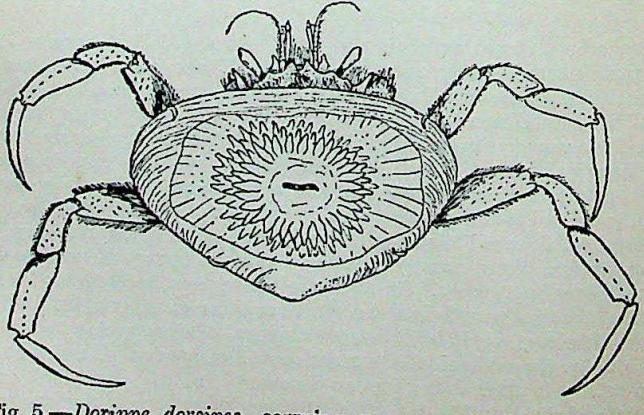


Fig. 5.—*Dorippe dorsipes*, carrying an anemone seated upon a shell. (Original).

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D. dorsipes and *D. facchino* (Fig. 2). Both love sandy bottom, and *Dorippe dorsipes* is particularly numerous at Madras; numbers are often to be found in the rubbish thrown aside from fishermen's nets. Their usual habit here is to carry over their back a valve of some species of thin bivalve shell, concave side down, of size suitable for effective concealment. The illustration given (Fig. 5) shows the usual appearance of this crab when carrying his buckler in position, held securely by the claws of the two last pairs of legs; the points of these claws show over the edge on both the fore and hinder margins of the shell. In many cases, the defence is increased by the presence on the surface of the shell of a little pale-coloured anemone. Just as the association of *Synapta striata* with the spider-crab already noted, gives added protection because of the burr-like spicules in the skin of the synapta, so here the crab, perching an anemone upon the concealing shell, provides himself with a whole series of ready-made batteries of stinging cells, capable of frightening away any small fishes that might otherwise penetrate the disguise of the concealing shell. Hermit-crabs are known to transfer the anemone *Adamsia* from other gastropod shells to those which they use for their own habitation, so here it seems certain that *Dorippe* has a related habit, but whether it merely selects a shell on which an anemone already is settled, or whether it actually detaches the anemone from its first foothold and then transfers it to the shell which it has already selected for its concealing cloak is not known. This is one of those interesting points that can only be settled by keeping these animals under close observation in an Aquarium.

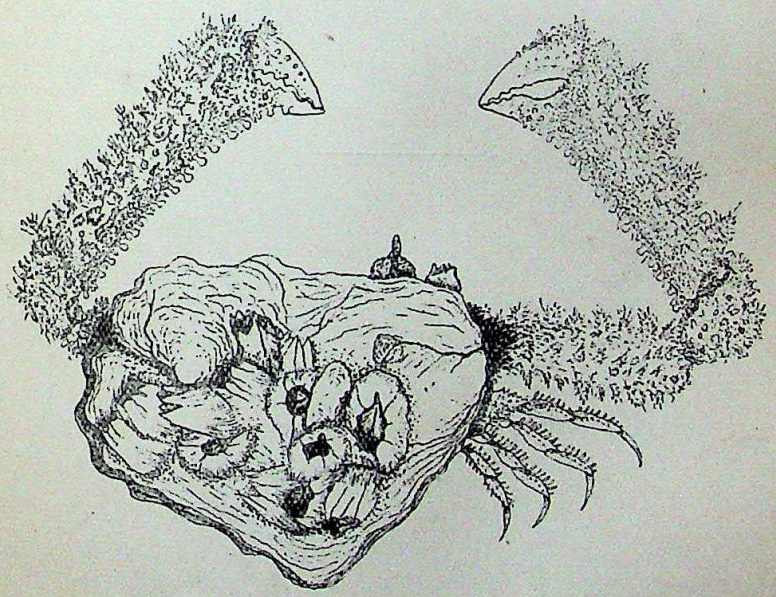

Fig. 6.—*Lambrus*, a crab that lives on shingly bottom; the carapace in this case is concealed by a mask of oyster shells and barnacles. (Original).

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Figure 6 shows a form of masking brought about, not by deliberate action on the part of the crab, but through its pure passivity and slowness of movement. It is a *Lambrus*, whereon an oyster (*Ostrea* sp.) has settled, and grown so as to cover the whole of the carapace and the legs on the left side. This crab lives on pebbly bottom and when at rest with the chelipeds folded close to the body and the other legs tucked down, such an individual as this would look a worthless morsel to tackle. The association is of long standing, for on the original oyster two younger ones have settled, together with over a dozen barnacles (*Balanus*). *Lambrus* like *Calappa* shams death, when disturbed.

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"THE BIRDS OF MESOPOTAMIA."

BY

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ASSISTED BY

P. A. BUXTON, M.A., M.B.O.U., late Captain, R.A.M.C.

AND

MAJOR R. E. CHEESMAN, M.B.O.U., 5th Buffs.

PART IV.

(With 1 plate.)

(Continued from page 674 of this Volume.)

290. Common Gull. Larus canus.

Larus canus canus L. (Syst. Nat., 1758, p. 136—Sweden).

A fairly common winter visitor, more particularly perhaps to the river from Sheik Saad downwards. Buxton did not observe it before December and it remained common at Amara till the end of March, when it left suddenly. Neumann records it from Ras-el-Ain in February.

Six specimens examined : Sheik Saad, ♂, 14-12-16 ; ♀, 10-2-17 (P. Z. C. and R. E. C.) ; ♂, Sheik Saad, 28-1-18 ; ♀, 24-1-18 (Robinson) ; ♀, Amara, 13-1-18, 11-2-18 (P. A. B.)

291. Yellow-legged Herring Gull. Larus argentatus.

Larus argentatus cachinnans Pall. (Zoogr. Rosso-Asiat. 2, 1827, p. 318—S. E. Russia).

A common winter visitor ; very numerous at Fao and not uncommon up the rivers, particularly at the sites of larger towns where food supply in the shape of offal abounds, up to and beyond Baghdad. It is recorded in every month of the year, so some non-breeders must spend the summer ; it is recorded from Basra on May 28th and in August, while by September 7th it is common at Baghdad, whence it is also recorded in mid-July and June ; Meinerzhagen records it scouring even the desert for food.

There is no evidence of the European Herring Gull occurring in Mesopotamia.

One skin examied : Amara, 27-11-17 (P. A. B.).

292. Lesser Black-backed Gull. Larus fuscus.

1. *Larus fuscus fuscus*, L. (Syst. Nat., 1758. p. 136—Sweden).
2. *Larus fuscus taimyrensis* (=*affinis* auct.) But. (Mess. Orn. 1911, p. 149—Yenissei).

(1) While anchored at Fao bar on November 23rd, 1917, and again on March 16th, 1918, I saw several adults of this species. Round the ship were many *taimyrensis* and *cachinnans* quarrelling for scraps, and amongst them the almost

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black mantle of these birds at once drew attention, while as they dipped for food their bright lemon-coloured legs were easily seen.

There are no other records of this species, which is probably a winter visitor to Fao district in small numbers ; Fao must be about its limit east.

(2) The Siberian Lesser Black-backed Gull is common, especially at Fao and what has been said about the Herring Gull applies apparently equally well to this bird, except that there is no record of it north of Baghdad.

293. Great Black-headed Gull. Larus ichthyaetus.

Larus ichthyaëtus, Pall. (Reise, Russ. Reichs. 2, 1773, p. 713—Caspian Sea).

Magrath saw huge gulls with black heads on the Suweikiyeh Marsh in August which could only have been of this species.

There is no other record, but it is a bird which of course is quite likely to occur. The Sooty Gull (*L. hemprichi*) which certainly occurs in the Gulf is as yet unrecorded at Fao ; though on the look out for it, I failed to see it west of Bunder Abbas in November and March.

294. Black-headed Gull. Larus ridibundus.

Larus ridibundus, L. (Syst. Nat. Ed. 12. 1766, p. 225—England).

A winter visitor, very common from Fao on both rivers to Hit and Tekrit respectively. It arrives back quite early, some being noted by mid-July near Baghdad, and some may still be seen at the end of May. Possibly a few non-breeders may spend the summer as in the case of the Herring Gull, though there are no actual records in June or July. Pitman says it was quite absent from the marshes of the Hindia Barrage, etc., in these months and there is no evidence that it breeds in our area. It assumes its breeding plumage before leaving in the spring. They become very tame and used to the various river craft which ply in the port of Basra, and Pitman relates that he saw a *bellum wallah* actually catch one in his hand as it flew over his *bellum* in Aschar creek. There is no record of *melanocephalus* in our area.

♂♀, Sheik Saad, 14-3-17 ; ♂, 20-3-17 (two) (P. Z. C. and R. E. C.), ♂ Sheik Saad, 15-1-18 (Robinson). Amara, 13-1-18 (P. A. B.) ; Basra, 20-11-7 (C. B. T.).

295. Little Gull. Larus minutus.

Larus minutus. Pall. (Reise Russ Reichs. 3, 1776, p. 702—Siberia).

Zarudny records this as a passage migrant in the Karun district.

There are no other records ; it is not unlikely to occur in small numbers.

296. Slender-billed Gull. Larus gelastes.

Larus gelastes, Licht. (Theinem,. Fortpf. Vog. Eur., pt., 5, p. 22 1838—S. France).

The Slender-billed Gull is common and resident; in winter it is widely distributed and may be met with frequenting the rivers in flocks from Feluja and Samarra southwards, as well as flooded areas. In summer they congregate in their breeding grounds, which are the marshes and lakes in the Hindia Barrage area and elsewhere.

Here near Museyib, Pitman found them in thousands in June and July ; on June 12th he found a colony of grass-built nests on islands in the marshes which, though no eggs were found, he certainly took to belong to this species. Buxton records that it probably breeds in the marshes 20 miles east of Amara, where he obtained a bird on July 10th. It certainly breeds near Fao, where Armstrong found an egg in June which had been flooded out of its nest by the tides sometime previously. The egg was on a small mound in that part of the mud-banks

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which are liable to be flooded by spring tides, and which lie between Fao and the Abdulla Banks : from the latter neighbourhood Cumming obtained eggs on April 24th, 1884. Tomlinson found an egg of this Gull in the marshes near Basra about June 9th, 1913.

Just before and just after the breeding season this species may be met with in huge flocks on floods. such as existed at Akkarkuf near Baghdad.

Three skins examined : Akkarkuf 6-10-17 : ♂, Halfayah, 6-7-18 (P. A. B.) ; Hindia Barrage, 8-7-17 (C. R. P.).

297. Whiskered Tern. Hydrochelidon leucopareia.

Hydrochelidon leucopareia (Temm.) (Man. d'Ornith. 2nd Ed. 2, 1820. p. 746—Hungary).

Cumming has recorded that the Whiskered Tern is resident all the year at Fao though all the specimens he obtained were got in August and September. Pitman says it first arrived near Feluja on April 23rd ; he saw many on the inundations west of Baghdad at the end of May. In June he found it breeding in the marshes of Babylon, Kerbela and Museyib, on both banks of the Euphrates, and took two nests of one and two fresh eggs respectively on June 3rd, and obtained a breeding bird. The nests were quite large made of grasses and aquatic plants and were almost in the water on a semi-submerged strip of land in the centre of a large marsh ; he found also many empty nests. The eggs were pale stone and pale clay buff, sparsely spotted and blotched with brownish surface, and purple-grey and slate shell markings. They average 1·585 × 1·215 inch or 40 × 31 mm.

It is noted as common near Baghdad from mid-July onwards, also on Suweikyeh Marsh and Cheesman obtained one at Sheik Saad on December 15th.

298. White-winged Black Tern. Hydrochelidon leucoptera.

Hydrochelidon leucoptera (Temm.) (Man. d'Ornith., 1815, p. 483—Mediterranean shores).

A common summer visitor to the marshes of lower Mesopotamia ; it arrives about the middle of April till well on into May and may then be found feeding in flocks over cornfields, stubbles, etc.. as well as marshes and on the rivers. So far as I am aware no eggs were actually taken but there can be no doubt that it breeds. Magrath says it nested on the shores of the Suweikiyeh lake ; Tomlinson saw pairs near Basra in the breeding season, and Buxton found it common near there on May 28th and saw some on the Hamar lake on the 15th. On the marshes round the Hindia Barrage, Pitman found it fairly common in June and July and obtained a bird on June 12th, he thought that probably some of the empty nests he found there belonged to this species and that on June 3rd most of these and Whiskered Terns had hatched out. He saw plenty of young on the wing there on July 2nd. After the breeding season they spread out to other marshes and floods, and Pitman noted that in August flocks were coming to the marshes near Baghdad to hawk insects at dawn and in the evening, while they were absent during the rest of the day. Buxton noted flocks passing up the river, probably on passage, every day at Baghdad from September 7th to 24th and this letter date is the last on which there is any record. This species was recorded in many places from Tekrit to the Karun river, but the only places where there was at all any evidence of its breeding are those mentioned.

Zarudny curiously omits this Tern from his list, but says the Black Tern (*H. nigra*) is a passage migrant. We have no records of this species.

299. Common Tern. Sterna hirundo.

Sterna hirundo, L. (=*fluviatilis*, auct.) (Syst. Nat. Ed. x, 1758, p. 137—Sweden).

The Common Tern seems to be resident in Mesopotamia moving about locally but as there few winter records perhaps the majority are summer visitors

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Zarudny says it occurs in winter in the Karun river and Pitman records it all the year on the rivers and marshes but nowhere common except at the nesting places. By March 20th I found it common on the lower reaches of the Shat-el-Arab, otherwise all the other records relate to the breeding season.

Tomlinson says it breeds near Basra early in June on sandy islets in the inundation ; Cheesman found it breeding at Gurmat Ali and the Hamar lake, and Buxton on the drying marshes east of Amara. It probably breeds at Ahwaz. Pitman found large colonies nesting in June in the marshes of the Hindia Barrage; no nest was made, the eggs being laid in a scrape or natural depression ; over 100 fresh eggs were examined on June 2nd and 3rd and many eggs were destroyed through the rising of the water ; 49 eggs varied from 1·33-1·6 × 1·04—1·2 inches (or 33·75—40·5 × 26·5—30·5 mm.) ; the ground colour varied through all shades of green to almost deep blue. This Tern probably nests in many other places, such as the Tekrit area where Logan Home saw it in June.

Skins obtained : ♂, Basra, 19-4-17 (P. Z. C. and R. E. C.) ; Hindia Barrage, 2-6-17, 25-6-17 (C. R. P.).

Several observers thought they saw the Arctic Tern in Mesopotamia, but so far we have no evidence that it occurs.

300. Little Tern. Sterna minuta.

Sterna minuta minuta, L. (Syst. Nat. Ed. xii, 1766, p. 228—S. Europe)

The actual status of the Little Tern is doubtful, probably most are summer visitors, though perhaps here and there a few spend the winter. Thus Pitman says that at Kut some were seen after heavy rain in winter and I saw two over the river at Basra on November 23rd.

On April 18th Cheesman noted parties flying up the river at Basra all day, evidently a movement up to some breeding ground ; Pitman records the arrival at Feluja on April 29th.

It breeds in many places from Tekrit to Fao ; the site usually chosen is the bare dry ground on the edge of a flooded area, or islands in marshes, and consequently, as with the Common Tern, many nests are destroyed when the floods rise. Two eggs form the usual clutch, but sometimes three are laid ; 13 eggs average 1·15—1·29 × ·9—·97 inch (or 26·5—32·75 × 22·75—24·5 mm.) according to Pitman who says the ground colour in some cases was greenish stone. It breeds on sandy islands on the Karun at Ahwaz. The majority have left by the end of September, and Buxton records an apparent migration up the Tigris at Baghdad from the 7th to 26th.

Four skins examined : ♂, Fao, 12-5-18 (Armstrong) ; Kurna, 8-6-19 ; Basra, 16-8-19 (Logan Home). ; Basra, 18-4-17 (P. Z. C. and R. E. C.).

Besides these there are a good many from Fao in the B. M. ; all belong to *minuta*, the typical race, and not one of them is *saundersi* (the type and a large series of topo-types of which I have examined). *Saundersi* has been recorded from Fao by Sharpe and is said to breed near the Abdulla Banks. Armstrong's bird which was breeding on the dry mud above high water mark at Fao however, and all Cumming's birds in the B. M. are *m. minuta*.

Zarudny records *saundersi* as rare in winter in the Karun district, but at present I consider that it should be deleted from the Mesopotamian list.

301. Large Crested Tern. Sterna bergii.

Sterna bergii velox, Cretzsch (Rupp. Atlas, p. 21, 1826).

Cumming states (Ibis. 1891) that he obtained six eggs at Fao ; probably it breeds on one of the islands in the head of the Gulf and must occur off the Fao littoral and the entrance to the Shat-el-Arab where Harrison says he saw it ; it is not likely to penetrate inland. According to Hartert it is the above race which occurs in the Persian Gulf,—I have seen no specimens thence.

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302. Lesser Crested Tern. Sterna media.

Sterna media bengalensis, Less. (Traitè, p. 621, 1831).

The only record of the Lesser Crested or Allied Tern I can find is that of one shot at Fao in June 1900 by Mr. Ffinch ; it is in the British Museum. It must occur commonly off Fao one would think ; it breeds on an islet near the island of Arabè in great numbers (*Hume's Nests and Eggs* 4, p. 299). Pitman thought he saw it on the floods near Baghdad but so essentially a sea tern is not in the least likely to occur inland. The White-cheeked Tern (*Sterna albigena* auct) may occur off Fao ; it breeds on Allah island 40 miles east of Bushire (Hume *l. c.*, p. 312) in June.

303. Lesser Sooty Tern. Sterna anæthetus.

Sterna anæthetus (Del. Faun. et Flor. Ins. 2, 1786, p. 92—Phillipine Islands).

This Tern breeds on Allah off Tungistan, east of Bushire in June and July (Hume *l. c.*, pp. 300, 312). Its only claim to inclusion is Zarudny's statement that he saw two skins which had been obtained at the mouth of the Karun river at Mohommera.

304. Caspian Tern. Sterna caspia.

Sterna caspia, Pall. (Nov. Comm. Petrop. pt. 14, 1, 1770, p. 582—Caspian Sea).

This fine Tern is resident in Lower Mesopotamia, and breeds on Warba island of the Khor Abdulla whence Huskisson obtained eggs and a parent bird for Butler on April 3rd, 1878 (*Hume's Nests and Eggs* 4, p. 296). In the non-breeding season it is not very uncommon on the rivers up to at any rate as far as Samarra and doubtless visits the lakes as well ; even in the breeding season odd non-breeding birds may be met with. It is commoner on the Shat-el-Arab than elsewhere.

305. Gull-billed Tern. Sterna anglica.

Sterna anglica, Montagu (Orn. Dict. Suppl., 1813—England).

The Gull-billed Tern is also resident and is fairly common. I saw them at intervals all the way up the river to Basra on November 20th and again on March 16th. Cumming records that it is resident and breeds on both sides of the river at Fao. It also breeds on Warba island abundantly in a tightly packed colony, but on a different part of the island to the Caspian Terns ; eggs were obtained by Huskisson on April 3rd, 1878 (*Hume's Nests and Eggs*). Pitman thinks that some were breeding on dry islands in the flooded area of the Euphrates marshes near Museyib, but eggs he obtained in the first week of June are all far smaller than any known eggs of this species and measure about 43·7×31·75 mm. ; as he did not see the birds on the nests it is very doubtful whether these eggs belong to this species though it is quite possible they were breeding there as he saw and obtained specimens.

Two skins examined :—L. Akkarkuf, 12-8-17 (C. R. P.), Basra, 21-11-17 (C. B. T.).

306. Great Crested Grebe. Podiceps cristatus.

Podiceps cristatus cristatus, L. (Syst. Nat. 1758, p. 135—Sweden).

So far as is known the Great-crested Grebe is a winter visitant in small numbers to the rivers and inundations. Pitman obtained two adults in breeding dress on L. Akkarkuf on August 21st, so that it is within the bounds of possibility some may breed in our area ; all other records relate to the winter months.

Five skins examined :—♂, Amara, 17-12-18 (P. A. B.); ♂, Amara, 7-1-18 (P. Z. C. and R. E. C.), 2 L. Akkarkuf, 21-8-17 (C. R. P.); Amara. 12-2-17 (Bagnall).

These seem in no way different to west European examples.

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307. Black-necked Grebe. Podiceps nigricollis.

Podiceps nigricollis nigricollis, C. L. Brehm. (Vög. Deutschl., 1831, p. 963—E. Germany).

Apparently resident in small numbers; Pitman records that he found this species breeding in the marshes west of Museyib near the Barrage in May and June and that it was still present in July.

He found two nests on June 2nd each containing a single egg; these measure 1·83×1·21 and 1·74×1·23 inches. On L. Akkarkuf he often saw 6 or 8 adults together in August and obtained specimens.

In winter this species spreads out and may be found in the rivers; Neuman records it from Ras-el-Ain.

Five skins examined: Amara, 25-12-17 (P. A. B.); Kut. 18-3-18 (Hobkirk); Sheik Saad, 13-12-16 (P. Z. C. and R. E. C.); ♂♀, Sheik Saad, 22-12-17 (Robinson).

308. Little Grebe. Podiceps fluviatilis.

Podiceps fluviatilis capensis, Salvad. (Ann. Mus. Civ. Genova., (2) 1, p. 252, 1884—Shoa).

The Little Grebe is fairly common and resident. Pitman found it breeding commonly in the marshes west of Museyib in June and during the first fortnight of that month found many nests, quite a number being in quite a small area. The nests contained 4 to 6 and even 7 eggs in various stages of incubation. These measured 1·305—1·51 × ·915—1·09 inches (or 33—38·5×23—27·5 mm.) they varied much in size and shape.

Tomlinson recorded it breeding at Basra and found six nests in a small area on June 9th. In winter it spreads out and may be found on the rivers and inundations where it is not to be found in the breeding season.

Three skins examined: ♀, Amara, 15-2-18 (P. A. B.); L. Akkarkuf, 19-7-17 (two) (C. R. P.).

These are clearly *capensis* and not the European bird; in the latter the white of the flight feathers is always confined to the inner webs of the secondaries; in *capensis* the amount of white is more extensive on the secondaries and extends to the outer web also; moreover the white extends to all except the first three or four primaries, always on the inner, often on to both webs.

309. Water Rail. Rallus aquaticus.

Rallus aquaticus korejewi, Zar. (Orn. Monats., 1905, p. 209—N. E. Turkestan).

The Water Rail is a winter visitor, probably fairly common, but, like all Rails, being unobtrusive few came under observation. It appears to be generally distributed in suitable localities and the records range from September 10th to February 9th.

One was caught in a "dug out" at Samarra.

Four skins examined:—♀, Basra, 9-2-19 (Armstrong); Samarra, 24-12-17 (C. R. P.); Sheik Saad, 10-9-17 (P. Z. C. and R. E. C.); one Amara (P. A. B.). These I refer to the eastern race with the paler markings on the upper parts.

310. Spotted Crake. Porzana porzana.

Porzana porzana, L. (Syst. Nat. Ed. xii, 1766, p. 262—France).

This Crake is not very uncommon on both migrations and most come under observation by being caught exhausted or being found dead under the telegraph wires. We have no evidence that it breeds or winters on Mesopotamia; there are several records between March 18th and May 20th in the spring and August 27th and October on the autumn passage.

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Photo. Capt. C. R. Pitman.

A.—Nest and eggs of Little Grebe. 12-6-17.
Near Euphrates Barrage. (Eggs uncovered for photo.)

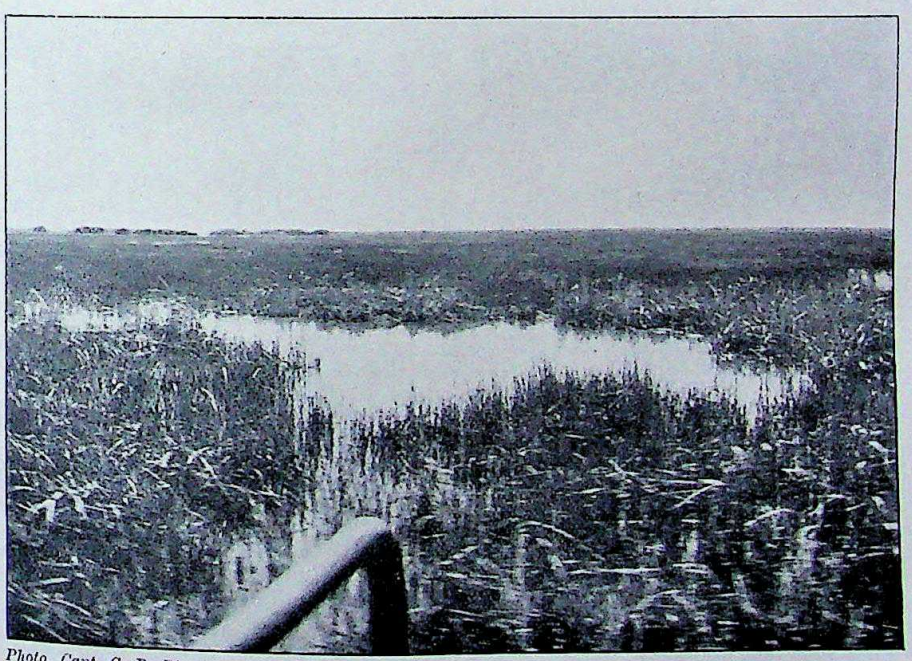

Photo. Capt. C. R. Pitman.

B.—Marshes near Kurna, R. Tigris.
Amongst other breeding birds in these parts are:—Pygmy Cormorants, Darters, Little Grebes, Reed Warblers, Gallinules.

BIRDS OF MESOPOTAMIA.

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Six specimens obtained : ♂, Shaiba, 23-9-16 ; ♀, Sheik Saad, 7-4-17 (P. Z. C. and R. E. C.); L. Akkarkuf, 27-8-17 (C. R. P.); Amara, 20-3-19 (L. Home); 2, Amara (P. A. B.).

311. Little Crake. Porzana parva.

Porzana parva, Scop. (Ann. I Hist. Nat., 1769, p. 103—Carniola).

Apparently a winter visitor and not very uncommon.

Cheesman obtained one at Sheik Saad on September 13th out of a melon bed. Pitman thought it was fairly common in the marshes of Kurna on March 24th. Tomlinson records it from Basra in February and on May 16th. Zarundy gives it as a winter visitor.

Four skins examined : ♂, Basra, 8-3-17 (Stevens) : ♀, Sheik Saad, 13-9-17, (P.Z.C. and R.E.C.); ♂, Feluja, 23-4-17 (C. R. P.) ; Samarra, 11-3-18 (Hobkirk).

312. Baillon's Crake. Porzana pusilla.

Porzana pusilla intermedia (Herm). (Obs. Zool. 1, p. 198, 1804—Strasbourg).

Cumming obtained one at Fao in October and records it as a winter visitor. Pitman says he saw several in the marshes at Kurna whilst shooting in January; Cumming's bird belongs to the above race.

313. Corncrake. Crex crex.

Crex crex (L.) (Syst. Nat., 1758, p. 153—Sweden).

The Corncrake is a passage migrant in spring and autumn, it arrives during the last half of April and may be met with till the third week in May ; the return passage begins about the middle of September and lasts well into October. At these times it is not uncommon. Cumming has recorded that stray ones may be seen in June and July and all have gone by the beginning of December ; we have no evidence of it remaining to breed nor have we any winter records. It is interesting to note that this bird was found at the Oasis of Shaiba on the autumn passage and one must suppose that it intended to continue its flight across Arabia ; in slight confirmation of this I may mention that I obtained some years ago the wings of corncrakes from two Red Sea light-houses on spring and autumn migrations, together with those of a Scops Owl, Persian Bee-eaters, Rollers, Quails, Spotted Crakes, etc. (Sanganeb Lt. off P. Sudan and Daedalus Lt.).

Four specimens examined : ♀, Shaiba, 17-9-16, 4-10-16 (P. Z. C. and R. E. C.); Feluja, 20-4-17 (two) (C. R. P.).

314. Water Hen. Gallinula chloropus

Gallinula chloropus parvifrons. Blyth. (J. A. S. B. 1843, p. 180—Calcutta).

Common everywhere in the marshes in winter and also breeds in suitable places. Probably a certain number are winter visitors and passage migrants. Cheesman records that one was shot from the top of a 30-foot Tamarisk at the Oasis of Shaiba on September 30th which, had it resumed its migrations, must have taken it into Arabia. Logan Home found two nests at Basra on May 22nd and Tomlinson records finding eggs there from June 9th to 21st. Cheesman noted that a pair took up their quarters and apparently intended to breed in a small reed covered pool which after being dry and bare for six months had become filled by the river floods in April.

Hobkirk found a nest of eggs on June 6th at Girdilaun.

Four skins examined : ♀, Basra, 6-2-19, w. 152·5 (Armstrong); ♂, Kazimain. 6-5-19 (breeding), w. 166; ♂, Shaiba, 30-9-16, w. 170 (P. Z. C. and R. E. C.); ♀, Amara, 6-4-18, w. 153 (P. A. B.).

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From the smallness of these birds they must belong to the eastern race *parvifrons* with which they well agree. Grant (Ibis. 1915, p. 47) in a review of races of the Water-hen gives as the measurements of this race : ♂, 155-175 ; ♀, 159-162. Our birds come well within these measurements, in fact the two females are smaller than his minimum.

It is interesting to find this race so far west and it is in keeping with what we know about the occurrence of not a few other eastern races in our area.

315. Coot. Fulica atra. "Dijaj Mai."

Fulica atra, L. (Syst. Nat., 1758, p. 152—Sweden).

In its general distribution the Coot is very common in winter in all the marshes and inundations while parties may be met with on the rivers right down to Fao. Probably many are winter visitors but in some places, at all events it breeds. Thus Pitman found many breeding in the marshes west of Museyib near the Barrage in June and on the 9th found a clutch of five incubated eggs ; in July, August and September he saw many adults and young ones. Buxton met with several on the Hamar Lake on May 19th so it is quite likely that it breeds there also. Livesay also obtained eggs, probably in the Euphrates marshes.

Magrath records that the Coots were very tame and familiar and used to swim round when "Tommy" was bathing and pick at the soap suds. The bridge of boats at Samarra was a constant source of annoyance to the flock of coots which used to live all day above it ; the current drifted them down to the bridge whence they used to flap up stream again to their chosen spot only to be drifted down again and so on *ad infinitum*.

316. Purple Gallinule. Porphyrio poliocephalus. "Birhan."

Porphyrio poliocephalus poliocephalus, Lath. (Ind. Orn. Suppl. p. lxviii, 1801—India).

Common and resident in all suitable large marshes, where reeds are plentiful; Cheesman records that it was apparently going to breed in the Horr Sanef. Buxton found it breeding in the Hamar Lake on May 19th—21st where he found their nests containing three to four eggs, fresh to much incubated. Pitman saw plenty in the marshes west of Museyib and found a nest of four eggs on June 9th nearly hatching. Marshall and Tomlinson found nests at Kurna, three eggs on May 15th and four eggs on May 3rd. Logan Home found it breeding plentifully at Abu Aran in June. The nest built in reed beds, where the water is two to four feet deep, resembles a coot's nest and is made of dead reeds with a few stalks bent over above to make a slight screen. The Arabs collect the eggs for eating.

Ten specimens examined : ♂ ♀, Horr Sanef, 20-3-18 (P. Z. C. and R. E. C.) ; ♂, Amara, 12-5-18 : 3 ♂, 2 ♀, Hamar Lake, 20-5-18 ; ♂, Amara, 5-1-18 (P. A. B.). Besides these I have examined three others on the British Museum from Mesopotamia.

The typical race comes from the peninsular of India ; there has been described a race—*seistanicus*—from Seistan by Zarudny and Härms (J.F.O., 1911, p. 240), differing from the Caspian bird by the paler coloration, and the Caspian bird has been described by Hartert as *caspius* (Novit. 24, p. 266) on account of its larger size as compared with the typical race. The question therefore arises as to what race the Mesopotamian birds belong. Hartert gives as wing measurements of *caspius* ♂, 270—286, ♀ 259—266 mm. Our birds measure ♂, 257—272, ♀ 239-255 mm., and three unsexed examples 224, 250, 253, so evidently our birds are not *caspius*, in fact they agree well in measurement with and are not at all paler than Indian peninsular examples.—Indian birds (both sexes) measure 237-271 mm. Nor can I find any difference by which our birds may be differentiated from Indian birds either in size of bill or tarsi or feet, all of which vary very much.

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Zarudny in his list of birds of the Karun district places *P. œruleus* ? as a common resident. The only information Zarudny had concerning Gallinules he obtained from the Arabs who described to him the birds and nests, and he supposed that it would be this species which occurred in the Hawaizie marshes. Jourdain informs me (*in litt.*) that he has 12 eggs of *seistanicus* from Mesopotamia ; I know not how he arrived at the determination of these eggs, the average measurements of which he gives as 50×37·5 mm. (almost exactly the same as Blanford gives for the Indian bird) ; if he was going on the eggs themselves it would only show that the eggs of these two races cannot be differentiated, as I am not aware that *seistanicus* occurs in Mesopotamia at all.

As Hartert described *caspius* from five birds from Lenkoran and two from E. Persia, it would seem highly probable that *caspius* is the same as *seistanicus*. *P. cæruleus* does not occur at all ; specimens, which were referred to this, in the British Museum from Mesopotamia are in fact *poliocephalus*.

317. Stock Dove. Columba ænas.

Columba ænas, L. (Syst. Nat. Ed. x, p. 162, 1758—Sweden).

Woosnam found the Stock Dove plentiful on the Diz and Kerkha rivers in the Karun district, where Zarudny also records it as a winter visitor and passage migrant. Pitman thought he saw it at Sheik Saad in January and at Kut in November. There is a specimen from Baghdad in the British Museum obtained by Loftus. Cheesman met with it. Brooking has recorded that it was heard occasionally at Nasariyeh and Ramadi. Zarudny has described a race-*hyrcana*-from the S. Caspian region ; two specimens I have examined from near Shiraz in winter differ in no way from English ones.

318. Wood Pigeon. Columba palumbus.

Columba palumbus palumbus, L. (Syst. Nat. Ed. x, p. 163, 1758—Sweden).

The Wood Pigeon is extraordinarily local in Mesopotamia. Round Basra it is not uncommon and as there are records of it there in small numbers from March to August, it must certainly breed there. Cumming records that, in one year only, many visited Fao and built in the date palms there, but left again as suddenly as they arrived. At Baghdad it appears to be resident and fairly common and it must breed there also, though no nests were reported ; Cheesman however was assured by the natives that they do nest there in the gardens. It occurs and is probably resident in the foothill towns of the Karun district as Diz, where Woosnam records it, and Shush, where Cheesman saw and heard them on May 3rd. Buxton, who was at Amara for some time, never met with it there nor at any other place during his wanderings except at Baghdad ; Pitman at Feluja, Museyib, and Samarra failed to see it and Logan Home only came across it at Basra. Brooking in his list of birds observed by him says the "Ring Dove" is common and breeds in the palm groves of the Euphrates, but he almost certainly refers to a Dove and not the Wood Pigeon. Hingston records it from Khanjedidah in April. Livesay obtained eggs but failed to supply any further details.

It would certainly seem that this Pigeon is a bird of palm groves, but yet does not occur everywhere the palm does. Its status requires further examination. Cheesman says the cooing and love flights are exactly similar to those of the English bird, but he noticed a constant difference in the bill which he says is "putty white," nostril pinkish, instead of the usual coloration ; he verified this in about a dozen birds shot in winter. This difference is lost in dried skins, as those which I have seen from Mesopotamia differ in no way from the English birds nor could I detect any other difference by which they could be separated ; to separate the Mesopotamian Wood Pigeon as a distinct race, therefore, only on coloration of bill in life would, I hardly think, serve any useful purpose.

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Six specimens examined: ♀, Baghdad, 21-9-17 (P. A. B.); ♀, Baghdad, 14-1 19, 22-1-19 (two); ♂, 11-2-19, 9-2-19 (P. Z. C. and R. E. C.).

The eastern form *casiotis* does not, so far as I am aware, occur.

319. Rock Dove. Columba livia.

Columba livia gaddi, Zar. and Loud. (Orn. Monats. 1906, p. 133—Karun R.).

Common and resident wherever suitable places exist; it swarms in most of the larger towns, as at Mosul and Baghdad, and is semi-domesticated, all being however pure blue, none of the mongrel kinds seen in most places having as yet been introduced. In the towns it frequents houses and particularly mosques and so enjoys a considerable amount of protection. Elsewhere it inhabits ruins, and the arch at Ctesiphon swarms with them; all along the cliffs in the Tekrit and Samarra districts it is abundant, and it nests in the Euphrates Barrage at Hindiyeh and in wells at many places. It is common enough in the towns of the Karun district and occurs in the Jebel Hamrin, as at Mendali, in cliffs many miles from any habitation. Where no suitable sites exist for it as at Kut, Ali Gharbi, Sheik Saad and Fao it is rare or absent. There is nothing very particular to note about its nesting habits; as elsewhere more than one brood is reared and Pitman records fresh eggs and fledged young in June. At the Barrage no nest is made, the eggs being deposited on the bare shelves.

Five skins examined: ♂, Mendali, 2-8-18 (P. A. B.); Adhaim, 15-11-17; Samarra, 7-3-18 (C.R.P.); ♂, Amara, 9-2-18 (P.Z.C. and R. E. C.); ♂, Shustar, 18-1-18 (F. M. B.).

In addition to these five I have examined two others from "Mesopotamia;" one from Biridjik; one from Kharag Is. off Bushire; three from Palestine; one from Muscat and a very large series from Afghanistan, Beluchistan, N. W. India and Turkestan. As regards the Palestine, Mesopotamian and S. W. Persian birds these are not the typical race, the upper parts are distinctly paler and the birds are smaller. Rock pigeons vary very considerably throughout their range and doubtless introduced stock in some places upsets all attempts at classification into races; but if one is going to recognize races of this pigeon at all, one must consider what race the Mesopotamian bird belongs to; it is certainly not *livia* as already pointed out, and it is equally certainly not *intermedia*. Several observers thought they saw *intermedia* in Mesopotamia because they saw Rock pigeons with bluish rumps. From the very large series I have seen from the above mentioned localities there was not a single example of *intermedia* (which is a fairly distinct race from Central and South India), and as for the colour of the rump in our Mesopotamian birds, it goes for nothing; some are pure white, others pale blue grey, and some are white tinged with this colour, but none has the slate grey of *intermedia*; it is purely an individual variation. Zarudny and Loudon described *gaddi* from the Karun river, their description tallies well with our Mesopotamian birds and the latter are all quite similar to a topo-type of *gaddi* from Shustar; quite the same also are the three birds from Palestine and the birds from Biridjik and Kharag Island—all are rather pale and rather small (wings 215—227 mm.) and therefore I consider *palestinæ* of Zedlitz (J. F. O. 1912, p. 339) to be a synonym of *gaddi*. The Muscat bird is paler than any others I have seen and more from this locality are desirable.

320. Turtle Dove. Streptopelia turtur. "Tabaan"

1. *Streptopelia turtur arenicolor* (Hart.) (Novit. Zool. 1894, p. 42—Fao).
2. *Streptopelia turtur turtur* (L.) (Syst. Nat. Ed. x. p. 164, 1758—England).

The eastern race of the Turtle Dove is an exceedingly common summer visitor to the whole of our area and also a passage migrant through the country. The

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first few arrive in the last days of March and they become numerous throughout April ; many leave during September and few are to be seen up to October 25th. Cheesman and Buxton found it rare at Baghdad and thought that it only occurred there on passage, its place being taken there, as a breeding bird by the Indian Ring Dove (*S. decaocto*); otherwise it breeds freely in all areas from Tekrit to Fao and Karun district.

Nests ready for eggs may be found in the last days of April ; eggs are reported during the first week of May and are general by the middle of the month and may be found well on into June ; its nesting habits do not appear to differ from those of the European bird.

Large flocks probably of passage migrants were noted in the Samarra district in April and in the willow jungles at Shush on May 3rd, while Magrath saw flocks migrating over the Sanniyat position regardless of a heavy artillery bombardment.

Eleven specimens examined : ♂, Amara, 6-6-18, 24-4 18. ♀, 26-10-18; ♂, Baghdad, 29 7 18 (P. A. B.) Sheik Saad, 2 4-17; Zobeir, 11-5-16; ♀, Basra, 2 8-16. Baghdad, 11-4-19 (P. Z. C. and R. E. C.). Wadi, 26-4-17 (?)

All these are *arenicolor* with paler wing coverts and scapulars, and usually paler mantle and head, than the European birds. One specimen shows the "rufous phase" which is also to be found in the typical race.

(2) The typical race according to Weigold passes through Urta on spring migration from April 16th onwards. Sassi records it from Mosul, Zarudny gives it as a passage migrant in the Karun district. Witherby identified one from Feridan in W. Persia obtained by Woosnam on May 10th as belonging to this race.

Pitman obtained two at Feluja on passage on April 11th which from their darker colour I assign to the typical race. They match British specimens well.

321. Indian Ring-Dove. Streptopelia decaocto (=risorius *auct.*) "Fuchtee."

Streptopelia decaocto decaocto (Friv.) (A. M. Tàrsàsag Evkönyvei, 1834-36, iii, p. 183, 1838—Turkey).

Where this dove occurs it is quite common and its breeding distribution is evidently much influenced by the presence or absence of date palm groves. From Fao to Kurna it is resident and breeds, as also up the Euphrates where palm groves exist and also at Baghdad where it is common.

In some places, such as Amara, Kut, Qalet Saleh it is a winter visitor and not at all common even then, a flock perhaps frequenting the same spot where food is plentiful, such as mule lines, etc., all the winter ; while in other places, as Feluja and the Samarra-Tekrit area where the locality is not suited to it, it would appear to be absent altogether.

It nests usually in palm trees, sometimes as high up as 30 feet, and the nesting season is a long one, eggs being reported early in May up to September.

Four specimens examined : ♂, Basra, 28-7-16: ♀, Kazimain, 30-3-19 (P. Z. C. and R. E. C.): ♀, Baghdad, 11-9-17, , 23-1-18 (P. A. B.)

322. Little Brown Dove. Streptopelia senegalensis.

Streptopelia senegalensis cambayensis (Gm.). (Syst. Nat. I. 2, p. 779, 1789—Cambay, Bombay Pres.)

The status of this dove is quite unknown in Mesopotamia. Cumming obtained one at Fao in January in a severe storm and Buxton got one female at Amara on February 1st, 1918. I have examined both these skins, whose wings measure 127·5 and 130 mm. and they are in no way separable from birds from the Bombay Presidency, and this species must be added to the list of those Indo-Beluchi birds which straggle along the Persian Gulf into Mesopotamia. Hartert (Vog. P. F. pl. 495).

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refers this Fao specimen to a larger race *ermanni* (from Bokhara) but both these Mesopotamian specimens are well on the small size for this and are not larger than many Bombay birds. Weigold records *cambayensis* from Aleppo and Biredjik as common and resident. I have seen no specimens thence but Hartert (t. c.) gives Palestine as being inhabited by the typical race and almost certainly these Syrian birds belong also to this race and not to *cambayensis;* moreover the wing length given by Weigold (149-150 mm.) is much too large for this latter race.

323. Spotted Sand-grouse. Pterocles senegallus.

Pterocles senegallus (L.) (Mant. Plant. Regni. An App., p., 526 1771 —"Senegallia").

The Spotted Sand-Grouse is common, and widely, but rather locally, distributed and is resident. It is not in most places so numerically abundant as *alchata*, and like the latter it is subject to local migrations in the country, due to exigencies of food, water and breeding ground. In most places the Large Pintail is the commoner bird and with them may be found a few Spotted, or the latter are in small flocks by themselves ; at Nasariyeh however the reverse is the case and in this district the latter bird is abundant, the former scarce, as well shewn by a bag made there on August 25th, when 7 guns obtained 140 *senegallus* and only 10 *alchata*. So too in the triangle Baghdad-Feluja-Museyib *senegallus* would seem to be the commoner bird, while in the Kurna-Amara district it is rare. Until we know more about the food supply of these two birds their curiously patchy distribution will remain obscure.

A good many breeding localities are recorded; it evidently breeds in some numbers along the edge of the Arabio-Syrian desert from Shaiba westwards ; it breeds also in numbers between Museyib and Baghdad (there being a very large colony about halfway) and between Baghdad and Feluja; it breeds in the Samarra and Tekrit districts and in places, though no large colonies are reported, from there to Basra. So little has been recorded concerning the breeding of this bird that I will quote the notes sent by Logan Home *in extenso:*—"On June 18th I set out from Chunabdah (about 40 miles W. of Basra) at 4-30 a.m.; the sun rose at 5 a.m., I saw large numbers of *Cursorius*, *P. alchata* and a fair number of *senegallus*. These all fed up to 7 a.m., when they commenced flying to water at the marsh edge six miles distant to the East. About 7-15 a.m. I saw a *senegallus* creeping through some small plants about 300 yards off, evidently having run off eggs. I sat down and watched it and in twenty minutes it had come back a bit and squatted. I gave it ten more minutes to make sure it was on its nest and then walked to the spot and found nil ! The bird ran off as soon as I stood up, although fully 300 yards away. I then moved to another position 500 yards away on the other side of the spot. About 8-40 a.m., another *senegallus*, a female, flew in towards where I was lying, and settling within a 100 yards ran to a spot and squatted down. I watched it for 10 minutes ; then another, the male,came along from the direction of the marsh to the same spot and, when within 10 yards of the squatting bird, the latter rose and flew off to the water and the former ran on to the same spot and remained there. I then knew there must be eggs and walking to the spot I found a nest containing three eggs. The nest was merely a slight scrape in the hard soil on top of a stony plateau about 20 feet above the surrounding plain. Further on I saw another *senegallus* female 400 yards away feeding; after 10 minutes watching she crept behind a small plant and squatted. The bird sat until I was about 20 yards away (it then being very hot) and then crept off trailing her wings ; the nest contained 3 eggs. She stayed quite close for some time and only rose when I walked right up to her.

From the above I gather that the male drinks first and then comes to relieve the female, which would appear to again relieve the male after drinking ".

Logan Home also obtained eggs from Tekrit on June 10th and, judging by the number of scrapes in the ground and the birds seen, quite a number must

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have been nesting in fairly close proximity—on stony ground. Tomlinson records eggs from near Basra on June 19th and Pitman found a stale egg near Museyib on June 27th. Cheesman obtained a chick in down at Shaiba on August 12th when many were fully grown.

A clutch of 3 eggs in my collection taken by Capt. Hanna on July 3rd near Ur of the Chaldees measure 42·5×29. All three were fresh and similarly marked; the ground colour is pale yellowish stone ("pale olive buff", Ridgw. xl. f.) rather sparsely but evenly marked with fine and coarser spots of pale red-brown ("tawny olive" Ridgw, xxix, i.) with a few larger secondary markings of "pale violet grey," (Ridgw. lii, d.); they are less closely marked and much less glossy than those of the common Indian Sandgrouse, indeed they are practically glossless. The male bird which was on the eggs ran off at very close range and performed the usual "dying" trick.

All Sand-grouse are good eating in my experience but Pitman thought *senegallus* to be better in this respect than *alchata*. There is a certain amount of evidence to show that this species feeds on *only* small seeds and *not* on dropped corn, as *alchata* often does, although obtainable, but the identification of crop contents of both species and in a large number of specimens is desirable.

Eighteen specimens: Baghdad, 7-8-18 2, Nasariyeh, 25-8-18 (P.A.B.); ♂, Sheik Saad, 29-10-16. ♀, 30-10-16; *pull.* Shaiba, 12-8-18 (P. Z. C. and R. E. C.); 2 ♂, Twin Canals, 3-11-18; ♀, Kut, 24-11-16 (C. R. P.) 5 ♂, 3 ♀ nr. Kut (Keary and Perreau).

Down Plumage.—So far as I am aware the young in down of this species has never been described. Cheesman's bird is of the same age as the young of *alchata* referred to and, as the feathers have sprouted the down pattern is lost. *Chicks soon after hatching are desiderata*, as I believe this to be the only one preserved anywhere. I exhibited it at the December 1920 meeting of the B. O. C. and it is now in the British Museum.

Compared with the chick of *alchata* it has a noticeably smaller, less stout and less high bill, and shorter feet besides a different (paler) down and feather pattern.

Down. Upper parts.—Head, cheeks and ear coverts, a mixture as in *alchata*, but the ginger brown element much paler and their hair like filaments much shorter and less noticeable. Back and scapulars,—here the paler ginger colour of *alchata* is replaced by a pale sandy yellow with heavier black tips, here too the filaments are shorter than in *alchata*; wing coverts a mixture, like the back, and the filaments again shorter than in *alchata*.

Under parts.—Down fluffy, less hair like than in *alchata*, also not so white, more isabelline white.

Feathers of the upper parts quite different to *alchata*, pale isabelline brown grizzled with black marks; those of the under parts paler than in *alchata*, also smaller and more disintegrated. See plate p. 650.

324. Imperial Sand-grouse. Pterocles orientalis.

Pterocles orientalis (= *arenarius* auct.) (Syst. Nat. Ed. x, p. 161, 1758 —Anatolia).

Scattered flocks may be met with in winter throughout the country; these are winter visitors from the Persian plateau where they breed in great numbers; there is no evidence that it breeds anywhere in our area. Never what might be called common, yet it cannot be considered rare, small flocks may be met with by themselves, or a few mixed up with the packs of *alchata* or *senegallus*. They arrive somewhere about the middle of November and Cheesman records some as late as April 27th drinking at islands in the Karun river at Qazarieh.

Apart from their size, lack of the "pin tail", and the black belly Cheesman noted that their cry was distinctive, a croaking noise rather like a Raven's; Wimshurst obtained a number of minute seeds, estimated at 30,000, out of a

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crop, which were identified by Mr. Irving of Kew as those of *Melilotus*, sp., probably *indica*, and *Astragulus*, sp., in about equal proportions.

One skin obtained : Sheik, Saad 24-12-16 (P. Z. C. and R. E. C.).

325. Large Pin-tailed Sand-grouse. Pterocles alchata.

Pterocles alchata caudacutus (Gm.) (Reise d. Russ. iii, p. 93, 1774—N. Persia).

This is *the* Sand-grouse of Mesopotamia ; it is widely distributed, resident, and in most places excessively abundant. There are a number of records of the migrations of vast flocks in March in several areas, as in Kut, Feluja and Baghdad, etc., and again in the autumn from August to the end of October. These movements are accounted for in two ways ; this species has its own favourite nesting areas and breeds there in large scattered colonies, and so towards the nesting season birds draw towards these favoured places from districts where they have spent the winter. Other movements are doubtless explained by their flights to their drinking ground and to their feeding grounds ; also the latter sites are changed as frequently as the food supply is exhausted, or become untenable due to flooding or other causes ; then again in the rainy season these birds can push further out into the desert, not being dependant on the rivers and canals for their water, and so in this way perform a local migration.

There is no evidence at all that any Sand-grouse of this species visits our plains as either a summer or winter visitor, and all the movements noted are no doubt purely local.

Like all Sand-grouse this species is somewhat local ; in some places it swarms in countless myriads and yet large stretches of country may be traversed without seeing one ; the key to this of course must be food supply. Although it may be said to be in winter widely distributed throughout the country and very common, I will give one or two instances to show its erratic distribution ; Cheesman found it abundant at Kifri in January, but on a journey from Kanikin to Mosul none were seen ; Buxton, at Amara, says they are there in very irregular numbers throughout the year except in December and January, sportsmen agreeing that it was absent in mid winter there every year ; yet Pitman saw a large flock near there in January. Doubtless in this case different parts of these areas were worked with the above varying results. Most agree that it is uncommon at Nasariyeh.

This Sand-grouse breeds throughout our area from Ras-el-Ain and Mosul to Basra and Ahwaz, though there again its distribution is somewhat local and in some places as at Hindia, Feluja and Amara it is quite scarce or sporadic, or as round Baghdad where it is said not to breed at all ; in other places as Ahwaz, Tekrit, Mendali it is pretty common, while round Kut, Sinn Banks and Sheik-Saad enormous colonies exist. Pitman who was in this latter district during the breeding season and found many nests, has furnished a number of notes on the nesting of this species. Here he found these Sand-grouse very abundant in April and towards the end of the month they shewed evident signs of wanting to nest, but were much worried by the presence of troops on what was probably their old breeding grounds, and by the incessant firing of field guns and howitzers. The first eggs were found on April 25th, but it was not until the middle of May that nesting was in full swing, and he thinks that the birds had been delayed by the firing in starting nesting operations.

There must have been thousands of pairs in a few square miles of country and not a few of them were nesting between our lines and the Sinn position.

The " nest " is situated preferably on dry open flat ground especially on the dry outskirts of what had been a mud-marsh, though some were found in short stubble and grass. No nest is made but in a few cases a few bits of straw were found in the nest. The usual clutch is three eggs ; in one case two were normal in size and the third no larger than a dove's egg. Of twenty eggs taken by

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Ludlow at Ahwaz the largest measured 49 × 31, the smallest 39 × 28·5 and the average 44·36 × 30mm., these eggs varied very much in colour, they were mostly of a pale creamy-buff ground colour with dark brown or red-brown primary and violet grey secondary markings ; two eggs were nearly white, one with a few secondary markings, the other with a few faint markings of both degrees.

Pitman came to the conclusion that the eggs, once incubation had started, were never left unless the birds were compelled to, or the heat would kill the embryo ; he found many stale deserted eggs which were so hot as to be hardly handled ; Logan Home however says they sit very little !

Pitman several times saw the male sitting on the nest, but probably incubation is shared by both sexes, though the male was noted in each case on the eggs in eight nests found by Livesay. On being put off a nest with eggs, the incubating bird sneaks away, the head being kept low, and does not shew up till a long way from the nest, or it may feign a broken wing when 30 yards from the nest, this performance in nearly every case being done by the male. When the young are hatched more violent are the wiles utilized to deceive, which Pitman describes as follows :—" On the evening of June 15th I witnessed an interesting spectacle at a nest I had been watching and the eggs of which had hatched that morning. I saw the male sitting not far from the nest, but he at once went off playing the " broken wing " game ; as I got up to the nest the hen flew off under the pony's nose, having sat very tight and went away with a tremendous performance. First of all she went staggering away, then rolled over and over as if badly wounded and with both wings smashed. This not having drawn me away she went off again with tail elevated, wings drooping, and trailing on the ground head down and neck outstretched, every feather especially on the under parts fluffed out ; after a little of this display she got up and flew away."

Many nests were found in June and young in July and early August, but it is not certain that more than one brood reared ; many nests are destroyed by grass fires (burnt patches were found dotted with hundreds of semi-roasted eggs), Jackals, foxes, snakes, and birds of prey, so that late nests may well occur due to these causes. In August family parties or small flocks of seven to ten individuals are the usual thing, but later on the flocks mass into enormous packs.

At drinking time the flocks pack together on bare land before coming down to the water ; as all sportsmen know these birds have their favourite places for drinking, and where water is limited enormous numbers may here congregate ; in July, Pitman noted the first flocks arrive about 5 a.m., followed by other flocks, which all packed on the bare ground near by ; the whole lot rose with a deafening roar at 7 a.m. to come down to the water ; so numerous were they that shooting was sheer murder and some could be knocked down with a stick as they flew in, while the stream bank of both sides was packed five or six deep with birds.

They usually wade in and get wet or even settle in shallow water ; some drink hen fashion and others like horses do ; they go off directly after drinking either separately or reforming packs. In June they water from 6 to 8 a.m., and again at 5 to 6-30 p.m., but some may be seen going to drink all day long ; in the cold weather they drink from 8 a.m. till noon. In the heat of the day the flocks pack together to rest, and again for the night after feeding.

Their food consists of tiny seeds of a small grass like shrub, grains of cereals, pieces of green leaves, etc., while from one bird, of many feeding on newly sown wheat and barley, two ounces of cereals were taken and at this time of year the damage done must be considerable.

Pitman noted that during a sand storm these birds get quite lost and may then come into tents or can be even knocked down with sticks in the open. They dislike rain and the accompanying wetting of their plumage, as they then fly very badly and moreover are apt to get their feet clogged and balled with the clayey soil. Directly an area becomes saturated with moisture all the

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Sandgrouse move off to some drier district, and these local migrations from whatever cause are performed at a considerable height.

Their note is a harsh penetrating "Caa" followed by a softer "Craa"; both sexes too have an alarm note—"twoi," "twoi" "twoi".

3. Kumait, 17-11-17 (P. A. B.); ♂, Shaiba, 31-10-16; ♂ ♀, Sheik Saad, 3-10-16; ♂, Twin Canals, 22-11-16 (P. Z. C. and R. E. C.); ♂, Feluja, 14-4-17. ♀, 5-4-17; ♂ ♀, Samarra, 22-2-18 (C. R. P.); 2 ♀, Amara, 11-16 (Connor); ♂, Shaiba, 6-16 (Graham); Shaiba, 6-16 (Ingoldby); *pull*, Mendali 3-8-18 (P. A. B.).

Zarudny and Loudon have described (Orn. Monats. 1906, p. 132) a race *bogdanovi* from the Karun district. Mesopotamian birds compared with N. Persian birds shew no constant difference and I look upon this supposed race as being inseparable from *caudacutus*, and *bogdanovi*, therefore, a synonym.

The downy chicks of nearly all Sand-grouse are so little or else not known that I will give a description of the one obtained by Buxton. The chick has feathers sprouting and so the pattern is lost.

Down Plumage—Upper parts: Head, cheeks and ear coverts are a mixture running more or less in lines of (1) pale ginger brown with faint black tips, (2) creamy white; back and scapulars—a mixture of (1) and (2), the black tips on (1) more marked. This down is being pushed out by first feathers. Under parts are covered by a long, rather hair-like, down which is being pushed out by pale isabelline first feathers.

Wing coverts—On the lesser rows the down is pale ginger, on the rest creamy white. Everywhere the brown down carries long black hair-like filaments, especially noticeable on the head and neck; these filaments are carried one on each component of each tuft of down; the white down carries short white filaments longest on the coverts.

Feathers of the upper parts nut-brown with blackish border and whitish edges.

The downy young of this Sand-grouse was figured in the P. Z. S., 1866, plate 9.

326. Close-barred Sand-grouse. Pterocles lichtensteinii.

This Sand-grouse is evidently quite rare or very local. Magrath assures me that two or three were shot near Shaiba (whence the Society has a skin) and that he personally handled them, and he also met with it at Sanniyat. The Arabian desert border is the most likely place for it, as rocky hills are not far distant and it might occur along the Jebel Hamrin foot-hills; however there are no other records on which reliance can be placed. Zarudny records a supposed race of this Sand-grouse, *arabicus*, as a winter visitor, but of all Sand-grouse, I believe the rock haunting species to be the most sedentary.

The Coronetted and Common Indian Sand-grouse were reported to have been seen but no specimens were obtained, and further confirmation is desirable; Zarudny gives the latter as a rare winter visitor, and Cumming thought he saw it flying over Fao.

327. See See. Ammoperdix griseigularis (= bonhami *auct.*)

Ammoperdix griseigularis ter-meuleni (Orn. Jahrb., 1904 p. 221—Karun District, S. W. Persia).

Common and resident wherever hilly country occurs, as in the Ahwaz-Shustar district and all along the Jebel Hamrin range to Mosul, the cliffs and ravines of the Diala and Adhaim rivers and the Tigris from Sindia to Fatah Gorge, and at Hit on the Euphrates. It is eminently a bird of stony hill sides, ravines and broken nullahs; on the plains proper it never occurs. Common where it occurs, it may be found in coveys up to twenty (which break up into pairs about February), but no large bags are made, as it much prefers running to flying, and it can get over broken ground far quicker than the sportsman can! The breeding season is May and June. Cheesman found a female containing eggs on May 2nd, but full

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clutches are not to be expected till towards the end of the month. Aldworth found a nest of two eggs on May13th in the ruins ofAl-a-jib in the Samarra district, and Thornhill a clutch of eight on May 24th in the same district. Tomlinson has recorded the finding of nests at Bund-i-kir. Here the banks of the Karun are steep and rocky and about 40 feet high; from a likely looking hole about 10 or 12 feet from the ground a See See was flushed from the nest about two feet down the hole, the nest contained 11 fresh eggs on May 28th. Another nest on the same day was also in a hole about two and a half feet deep, like a small jackal's hole, in a sloping bank of a gully and contained 13 eggs. Mr. Jourdain informs me that the average of 23 Mesopotamian eggs is 36 × 25·8 mm.

Pitman noted that See See hide up in the day time and come out on to the plateau, scrub and camp areas to feed and drink morning and evening. The squeaky call note is rather like that of the *Ammomanes*.

Eight skins examined: ♂ ♀, Mendali, 3-8-18 (P. A. B.); ♂, Maidan-i-Naptun, 29-5-17. Shush, ♀, 3-5-17 (P. Z. C. and R. E. C.); ♀, Adhaim, 1-10-17, 11-11-17 (two); ♀, Samarra, 7-2-18 (C. R. P.)

There are also in the British Museum a pair from Bund-i-kir, a pair fromBushire and a male from "Mesopotamia."

Comparing this series with a series of typical *griseigularis* Mr. Kinnear and I have come to the conclusion that Zarudny's race is just recognizable (several sportsmen thought that the birds they got were different to the Indian ones). The Mesopotamian birds are, in the males, more sandy on the back and more vinous on the head; the more rusty coloration of the spots on the neck does not hold good; the females are distinctly paler and more marked in difference than the males. Wings: ♂ ♀, 121-140 mm. Young in down are desiderata.

Zarudny gives the typical race also as resident in small numbers in the Karun district, where his *ter-meuleni* is common!

328. Chukar. Alectoris græca.

Alectoris græca weræ (Zar. and Loud.) (Orn. Jahr. 15, p. 225—S. Lauristan and Arabistan).

There is little to record about the Chukar in our area, it certainly occurs in places in the Jebel Hamrin range as at Khanikin and Kizil Robat and probably elsewhere, while Brooking has recorded that a pair were seen in April near Hit on the Euphrates. There are two specimens in the British Museum labelled "Baghdad" obtained by Loftus, probably from the Jebel Hamrin, and Logan Home thought he saw it at Fatah Gorge.* It is common round Mosul. No specimens were brought home. I have examined these two Mesopotamian birds and five others from S. W. Persia and I think that *weræ* must be considered a distinct pale race. Wings: ♂ ♀ 155-179 mm.

329. Black Partridge. Francolinus vulgaris.

Francolinus vulgaris arabistanicus (Zar. and Harms.) (Ornith. Monats, April 1913—Arabistan).

The Francolin or Black Partridge is common in suitable places throughout our area; it is of course resident, inhabiting any thick scrub, especially tamarisk and liquorice, thick grass and cultivation of all sorts, a most favourite place being scrub along irrigation canals. Very good Black Partridge country is to be found between Kut and Sheik Saad and also up the Karun river. It is common in the scrub of the Tekrit flats, but at Samarra it is rare owing to unsuitable conditions.

The breeding season is May and June; Pitman at Feluja found three nests of five, seven and eight eggs respectively between the 6th and 8th of May and

* Since writing the above, Stoneham assures me that he knew of several obtained by sportsmen at Fatah, and I have heard of others being obtained in the more southern parts of this range.

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Cheesman found a brood hatched out at Amara on May 28th. A nest of five eggs is reported from Basra on June 1st, and a covey strong on the wing at the end of June at Kut, while a clutch of 6 eggs just hatching was found there on June 23rd. These discrepancies in dates of laying are doubtless due to accidents to first nests. The eggs vary much in colour; Cumming records four types—plain olive, dark olive, bluish olive and dark stone and the gives as measurements 1·6—2·0 × 1·2—1·35 inches (or in millimetres 40·5—50·5 × 30·5—34·3). The nest is a mere hollow in the ground and is placed usually in scrub and near water. The young are easily hand reared on flies, grasshoppers and grain.

The male starts calling early in March and calls up to July, a few do so in August and odd ones even in November, but as a rule it does not call in winter. Watts and Magrath, who both know the Indian bird well, considered that the call of the Mesopotamian bird was different; Ludlow and Thornhill both told me that the call had an extra syllable. The chicks make a noise like the chirrup of a cricket.

When Baghdad was first occupied this Partridge was common there but it rapidly became rare, and it was only a beneficent army order which saved it here and in other places from very serious diminution, a close season being instituted from March 15th to September 1st. They chiefly feed in the morning and evening, in the heat of the day they lie up in thick cover; where scrub is not available they may be found in the thick reeds along irrigation canals. From one bird shot at Beled 284 grains of barley were taken, but there is also a balance on the other side as Buxton found the crop of another bird crammed with the harmful locust *Decticus albifrons*, and probably the good they do outweighs the harm.

Nineteen specimens obtained: × Kut, 9-8-18; Amara, 28-5-18, 13-7-18, 17-1-18, 3-4-18, 4-11-17 ♀. 26-10-17, 20-10-17, 31-10-18 (P. A. B.); ♀, Qalet Salch, 25-11-17: (two) ♀, Kumait, 28-2-18; ♀. Amara, 25-12-17, 25-9-17 (P. Z. C. and R. E. C.); ♂, Kut, 11-16 (Perreau); ♂, Kut (Robinson); ♂, Basra 20-11-.17; ♂, 21-11-17. (two) (C. B. T.)

Besides these I have seen also in the British Museum three more males and four females (including three from Arabistan), making in all a fine series of 14 males and 12 females. Mr. Kinnear and I had a very large series of the typical form, of Beluchi, Sind and N. W. Indian birds for comparison. The birds from Arabistan are quite the same as those from the Mesopotamian plains; they certainly do not belong to the typical form, which is a darker bird, and they match in coloration exactly the Sind race *henrici* but are larger. The wings of the 14 males measure 163-178 mm., and of 12 females 154-168 mm.; the Sind race does not even overlap these measurements.

As a rule, but not quite invariably, the rump and upper tail coverts in the Mesopotamian birds are tinged with rust, occasional Sind birds shew this and occasional Mesopotamian birds do not. In all the races we examined, the white chin and moustache, a character some have relied on, was found to be very variable in occurrence; it is a purely individual character. Also, the white check patch is very variable in all of these five races, both in shape and size, partly perhaps due to make of skin, but in *vulgaris* and *arabistanicus* the patch is usually more or less ticked with black, which in Sind and Beluchi birds is seldom the case. Another character in races of Black Partridge which has been relied on is the amount of white spotting on the under parts of the male, this is purely individual in all races examined and the apparent amount is often influenced by the make of the skin.

The young in down of this race are *desiderata*, also half grown birds; it is interesting to note that a feathered chick from Fao is so pale compared with a similar one from Nepal (*melanonotus*, the darkest race of all) that one would hardly guess they belonged to the same species.

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330. Quail. Coturnix coturnix.

Coturnix coturnix coturnix (L.) (Syst. Nat. Ed. x, p. 161, 1758—Sweden).

The Quail occurs chiefly as a passage migrant, arriving early in March ; the passage lasts throughout April and into early May ; as elsewhere they frequent scrub, grass land and crops. It is fairly common in suitable places on passage ; as a winter visitor it occurs sparsely, never very common, in suitable cover all over the country singly, in pairs, or in small lots. Some evidently stay to breed in the country as Livesay obtained eggs and Pitman saw a covey of cheepers at Kut in the middle of June and in July. The return passage apparently takes place in September. Bags of up to 27 brace were got on spring passage.

Five specimens : Daur, 22-10-18 (two) (P. Z. C. and R. E. C.) ♂, Sulimania, 11-19 (Ross) ; Amara, 21-9-18 ; Kuwait, 28-12-18. (P. A. B.)

C. B. T.

Literature.

1870-72. Although it contains little relating to Mesopotamia proper, mention must be made of Vol. II of *Eastern Persia on account of the Journeys of the Persian Bombay Commission*, 1870-72. Birds occupy pp. 98-304 of Vol. II, in which 284 species are recorded.
Occasional references chiefly to the bird colonies in the Persian Gulf will be found in Hume and Oates, *Nests and Eggs of Indian Birds*, 3 vols. (1889-90) and the Birds (4 vols.) of *the Fauna of India* by the same writers.

1882. Canon H. B. Tristram. Ibis pp. 402-419. Ornithological Notes of a Journey through Mesopotamia and Southern Armenia in 1881.

1886. R.B. Sharpe. *Ibis*. pp. 475-493. On a Collection of Birds from Fao in the Persian Gulf with field notes by W. D. Cumming (99 species, recorded, first account of breeding of *Hypocolius ampelinus*).
R. B. Sharpe. *t. c.* pp. 493-199. On a Collection of birds from Bushire in the Persian Gulf (53).

1891. R. B. Sharpe. *Op. Cit.*, pp. 103-116. Notes on a second Collection of Birds made by Mr. W. D. Cumming at Fao in the Persian Gulf (includes 95 species and notes on eggs collected).

1899. W. D. Cumming. *J. Bomb. N. H. S.* XII, p. 760 (Letter on the nesting of *Hypocolius ampelinus*).

1903. H. E. Witherby: *Ibis*, p. 501-571. An Ornithological Journey in Fars, South-West Persia. (Notes on 163 species.)

1904-9. (In 1903-4 Zarudny travelled and collected in Western Persia and the Ornithological results of his journeys are embodied in a series of short papers and descriptions of new forms chiefly in the *Ornith. Monatsberichte* and the *Ornith. Jahrbuch.* A complete list of these papers will be found in the *Journal fur Ornithologie*, 1911,pp. 188-189).

1904. N. Zarudny. *Orn. Jahrbuch*, xv, p. 108, *Passer mesopotamicus*, spec. nov.

1906. N. Zarudny and H. Baron, London. *Orn. Monatsber.*, XIV, pp. 133-134, Zum Material uber die Asiatischen *Pterocles* und *Columbæ*.

1907. H. F. Witherby. *Ibis*, pp.74-111. On a collection of birds from Western Persia and Armenia ; with field notes by Woosnam (168 species).

1910. Rev. F. C. R. Jourdain. *Bull. B. O. C.*, XXV, pp. 72-73 (Exhibition of Eggs collected by A. G. Tomlinson near Basra, etc.)

1911. N. Zarudny, *Journ. fur Ornith.*, pp. 185-241. *Verzeichnis der Vogel Persiens* (an important list with notes on literature, Zoological regions and a distributional list of 716 forms with some Ornithological Notes).

1912-13. H. Weigold. *cit.* Op. 1912, pp. 249-297, 365-410, and 1913, pp. 1-40 " *Ein Monat. Ornithologie in den Wusten und Kulturoasen Nord-westmesopotamiens und Inneryisiens.* (127 species.)

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1912. N. Zarudny, U. M. Harms, *Op. cit.*, pp. 592-619 "*Bemerkungen uber einige Vögel Persiens*".

1912. M. Sassi. *Annalen d. K. K. Natur. Hist. Hofmuseums*, xxvi, pp. 116-119. *Liste von Vogelbalgen aus Mesopotamien* (List of 53 species chiefly collected at Mosul.)

1913. N. Zarudny, U. M. Hurms, *Journ. fur Ornithol.*, pp. 630-661, *Bemerkungen uber einige Vogel Persiens* II. Die Sperlinge Persiens.

1914. Capt. R. Meinertzhagen. *Ibis*, pp. 387-395. Notes from Mesopotamia.

1915. O. Neumann. *Journ. fur Ornithol*, pp. 118-123 "*Uber eine kleine Vogelsammlung aus Nord Mesopotamien*" [A small collection from Ras-el-Ain].

1916. N. B. K. (Kinnear). Notes on the Animals (Mammals, Birds and Reptiles) of Mesopotamia. [Birds, pp. 9-24 (Annotated list of 218 species based on Sharpe's and Witherby's papers published by the Bomb. N. H. Soc. and the B. M. Catalogue].

A. G. Tomlinson. *Journ. Bomb. Nat. Hist. Soc.*, pp. 825-829. Notes on the Birds of Mesopotamia. [Notes on 102 species observed chiefly near Basra and on the Karun R.]

1918. T. R. L. (Livesay). *Field*, 14th Dec. A Jheel on the Lower Euphrates [12 species recorded breeding].

Capt. C. B. Ticehurst. *Journ. Bom. N. H. Soc.*, XXVI, pp. 279-280. The Mesopotamian Bulbul.

W. D. Cumming. *t. c.* p. 292-295 Natural History Notes from Fao. (Corrections to the list of birds from Fao published in the *Ibis* of 1886 and 1891).

Capt. Thornhill. *Journ. Bom. N.H. Soc.*, XXV, p. 486. "Some notes on Game Birds of Mesopotamia."

1919. F. Kingdon Ward. *Field*, Jan. 18. "Notes on Mesopotamian Deserts."

H. F. Stoneham. *t. cit.*, May 17 and 24. "Bird Life in Mesopotamia."

Lieut.-Col. H. A. F. Magrath. *Journ. Bomb. N. H. Soc.*, XXVI, pp. 672-3. "Sand Grouse in Mesopotamia".

Maj-Gen. H. T. Brooking *t. c.* pp. 676-678. List of Birds observed in the Euphrates Valley.

Rev. F. C. R. Jourdain. *t. c.* pp. 860-1. "Mesopotamian Bird Notes" (Corrections to W. D. Cumming's paper, 1918).

C. H. Donald. *t. c.* pp. 845-6. "Some Birds of Prey of Mesopotamia."

Major R. E. Cheesman. *Bull. B. O. C.* XL, p. 59. (Exhibition of Nests and Eggs of *Passer moabiticus mesopotamicus*) (*c. f.* also *t. c.* p. 77.

P. A. Buxton. *t. c.* p. 60 (Exhibition of skins of *P. moabiticus mesopotamicus*).

1920 Capt. H. F. Stoneham. "An Ornithological Record." (Printed privately).

Some scattered note on the skins and eggs collected by W. D. Cumming will be found in the *Catalogue of the Birds* and *Catalogue of the Eggs in the British Museum*, 1874-1912.

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ON INDIAN PARASITIC FLIES.

BY

HAROLD RUSSELL, F.L.S., F.Z.S.

PART III.

With 3 Plates.

(*Continued from page 718 of this Volume.*)

IV.

THE PUPIPARA.

The Pupipara are a remarkable group of flies, with numerous Indian representatives, whose structure has been greatly modified in accordance with their parasitic habits. The Diptera already described are all parasites in the larval stage. In the Pupipara the adult perfect flies are parasites which feed upon the blood of their hosts. All the species of the three families, *Hippoboscidæ, Nycteribiidæ* and *Streblidæ*, are ectoparasites of warm-blooded vertebrates. They cling persistently to their hosts and seek to crawl in between the hairs or feathers. They are small to moderately large flies. Some forms are winged, others wingless. The winged forms rarely fly long distances, but use these organs of locomotion to pass from one part of the host's body to another, or occasionally, to fly from one host to another in the neighbourhood. The wings may be well developed, rudimentary or entirely wanting. In some species, though the wings may at first be well developed, they are subsequently shed, the insect, on reaching a host, having no further use for them.

The legs, on the other hand, as might be excepted in parasitic insects, are highly developed. They may be either short, strong and stout, as in Hippoboscids, or, on the other hand, as in the Nycteribiids, which are bat parasites, long, prehensile and slender. The claws are always adapted for clinging to the host and in some forms are toothed and provided with necessary spurs. The body is usually more or less dorso-ventrally compressed, which is another modification frequently found in parasitic insects. As a rule the segmentation of the abdomen is indistinct and its integument is of a leathery consistence. Some forms also are furnished with combs, or rows of spines, which are also organs associated with a parasitic life on mammals or birds.

The name *Pupipara* is really a misnomer, but it is a recognised name and long established. The eggs hatch in the body of the female fly. The larvæ are retained within the maternal body and are there nourished by special glands. When fully mature and ready to pupate they are deposited on the ground or in the abodes and nests of their hosts. Only one larva is produced at a time and on leaving the body

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of the mother it pupates. From what has been said it will be seen that the flies included in this group have developed most remarkable modifications and adaptations in connection with their parasitic habits. It is instructive to trace the stages in which the pupiparous habit has been developed. The word *pupiparous* is inaccurate because it is not a pupa which is produced from the mature female, but a full grown larva which may pass into the pupal stage on the spot where it is deposited by the mother, or may be capable of moving about until it finds a suitable place for pupation.

The pupiparous habit occurs in three distinct degrees in the Diptera. (*a*) It will be remembered that some Calyptrate Muscoids are viviparous. The eggs are retained within the maternal body until after they have developed into larvæ. The larvæ are very small and are born almost as soon as they hatch out of the egg. They are laid in a large batch, exactly as the eggs of most flies are laid, and undergo little or no development within the body of the mother. This habit probably originates from the circumstances under which the larval stage is passed. Some Tachinid flies, it will be remembered, deposit their young larvæ just hatched from the eggs, in the bodies of other larvæ on which they are parasitic. It is therefore of extreme importance, for their welfare and perhaps their existence, to reduce the duration of the immature stage so that it may be accomplished within a given time. The food supply will fail unless the larval stage of the parasite is completed before the host pupates. (*b*) The second degree occurs in certain Muscid species which are blood-suckers. There the larva on hatching is retained and nourished for part of its life within the body of the mother. But it is deposited before attaining maturity and completes its growth, feeding itself in the same fashion as the normal larvæ of the *Muscidæ*. (*c*) The third degree is found in the Diptera Pupipara where the larva is retained until it is ready to pupate. This involves remarkable changes in the internal structure of the female fly. The large size of the larva during the later stages of its growth renders it necessary that the internal organs of the mother should be greatly modified. More remarkable still is the development of "milk glands" to provide nourishment for the growing larva. The similar pupiparous habits which are found in the Muscid genus *Glossina* (the blood-sucking African Tse-tse flies) emphasize the close connection between the *Muscidæ* and *Hippoboscidæ*.

Hippoboscidæ. This family is probably familiar to Anglo-Indians, who are at all observant in matters of entomology, for the flies are common parasites of cattle and dogs. They are commonly known as "cattle-flies" or "dog-flies" and also as "skaters" and Kukumacchi. The native cattle do not seem to be much troubled by their presence or blood-sucking propensities, but dogs of British breed are worried to distraction.

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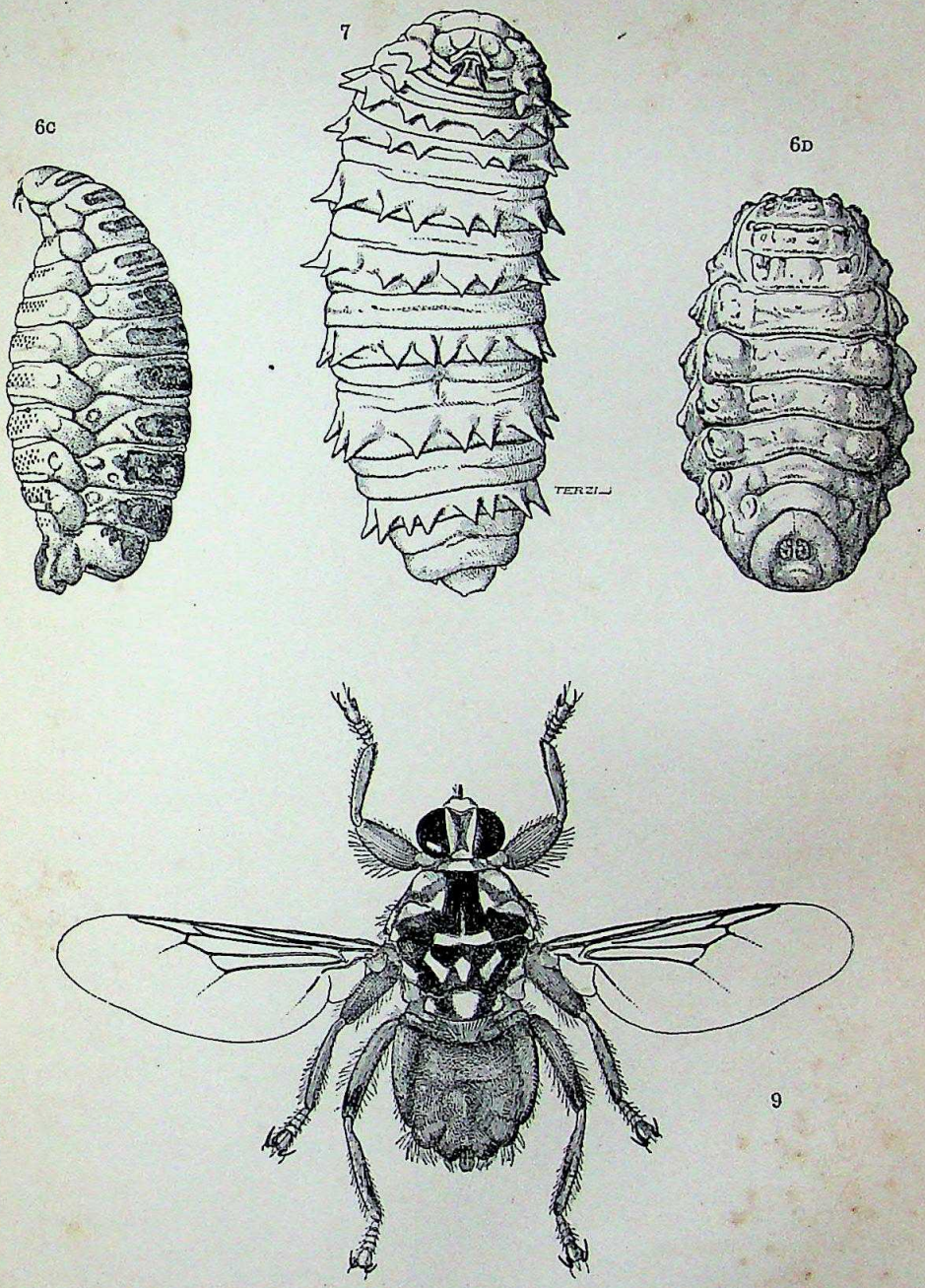

INDIAN PARASITIC FLIES.

6C.—Larva of *Œstrus ovis*, L. x 4.
6D.—Larva of *Hypoderma bovis*, de Geer. x 2½.
7.—Larva of *Cephalomyia maculata*, Wied. x 3.
9.—*Hippobosca maculata*, Leach, ♀. x 6.

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The greatest European authority on this family is Dr. Paul Speiser, a Prussian doctor of medicine and an entomologist, whose writings and researches during the last twenty years have added greatly to our knowledge.* The family has a world-wide distribution and somewhere about a hundred species have been discovered and described. Speiser has recognised five sub-families; but as one of these is confined to Madagascar where lemurs are their hosts it need not trouble us further. There occur in India representatives of the four other sub-families: *Hippoboscinæ*, *Lipopteninæ*, *Olfersiinæ*, *Ornithomyiinæ*. Until the family received attention from Speiser it had been much neglected. The Indian species are hardly known and the list in the late F. M. Van der Wulp's "Catalogue of the Described Diptera from South Asia" (1896) might be greathy added to. For instance, the British Museum collection contains specimens of the horse parasite *Hippobosca equina* L., a male from Upper Burmah and a female from Bengal; also the camel parasite *H. camelina*, Leach, a single female from South Afghanistan. Even *H. maculata*, Leach, one of the commonest Indian species is omitted from Van der Wulp's Catalogue. The British Museum has a good series from various localities in India and Ceylon.†

The Hippoboscids are flat and leathery looking flies with a short proboscis designed for blood-sucking and capable of protrusion when in use, but protected by the palpi when the insect is crawling among hair or feathers. The tip is furnished with sharp chitinous teeth to pierce the skin of the host. They are all blood-suckers and all parasites which spend more or less of their lives on the bodies of their hosts. The parasitism is reflected in the development of strong legs with powerful claws and small inconspicuous antennæ. The associated blood-sucking habit has led to the usual Dipterous life-history becoming reversed. In the present group the blood-sucking habit enables the adult female to supply nourishment of the richest description to carry on the life of the larva within her own body and the larva is born when about to pupate. The puparium looks like a brown shiny seed with a dark cap at one end. When first laid it is soft and white like a larva, which in fact it is. The mahogany colour and hard outer skin are assumed in a few days. These puparia may be found in dry places, on shelves or stone floors in cattle-sheds and stables. Where the hosts have nests, the larvæ are dropped in

*Dr. Speiser's chief papers are the following which should be referred to by anyone who knows German. They contain many suggestive remarks on parasitic Diptera: (1902) "Studien uber Diptera pupipara." Zeits. fiir syst. Hymenopterologi- und Dipterologie Vol. II. p. 145. (1905) "Beitrage zur Kenntniss der Hippobosciden." Idem Vol. V. p. 347. (1908) "Die Geographische Verbreitung der Diptera pupipari und thre Phylogenie." Zeits. fiir wiss. Insektenbiologie. Vol. IV pp. 241, 301, 420, 437.

† Notes on Hippoboscidae in the British Museum. By E. E. Austen, Ann. and Mag. of Nat. Hist. 7th Series, 1903. Vol. XII. p. 255.

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the nests and there pupate. The larva does not feed and only one is produced at a birth; but as the Hippoboscids have spread over the globe, and in some countries are relatively abundant, one must assume that the slow birth-rate is compensated for by the avoidance of manifold dangers which assail larval life.

Most Hippoboscids have no distinct neck and the head is sunk deep in the thorax, so as to be protected when working a way over the host's body. The wings of Hippoboscids are an interesting subject of study. In connection with the sedentary life, which parasitism tends to produce, there is a progressive reduction of the wings until in the genus *Melophagus*, which is a sheep parasite, wings are always entirely absent. These are wingless flies incapable of flight which pass the whole of their existence on their hosts and which can only get to a new host when the two sheep are touching or in close proximity. In the sub-family *Hippoboscinæ* the wings are well developed. In the *Lipopteninæ* the wings are very weak and often practically useless. In some species, which are parasites of deer, male and female flies emerge from the pupal stage with wings which they use to reach a host. Those of the female at once break off leaving a pair of stumps; or it may be that she rids herself of organs which are of no more use. Once in the coat of the deer she has conquered the problem of nourishment. The problem of reproduction involves a visit from a male fly. The males appear to retain their wings longer, possibly until they have found a deer with female parasites. Later in the season both sexes cohabit in a wingless condition as parasites in the hairs of the host. *Lipoptena moschi* is a parasite of the musk-deer. *L. gracilis* has been obtained in India from chevrotains. *L. pteropi* occurs in Ceylon on fruit eating bats.

In the *Olfersiinæ* the wings are well developed whilst in the *Ornithomyiinæ* they are often fairly substantial. In some cases they are reduced to mere rags or shreds. Now both these sub-families are typically bird parasites. *Lynchia exornata* Sp., which occurs frequently on pigeons in India, is a member of the first named group. It would seem that the wings are retained by the bird parasites as a useful adjunct in connection with winged hosts. When a bird infested by these flies is shot, one or more flies will often follow the sportsman who carries the dead host, sometimes alighting on him and seeking refuge in his hair, beard or clothing.

But even in the winged Hippoboscids there are signs of incipient atrophy of the wings which must be attributed to the effects of parasitic habits. The veins are crowded together along the anterior wing-border, whilst the few veins which run obliquely across the wing are lacking in strength.

Some account of the life-history and structure of *Hippobosca maculata*, a well-known Indian cattle fly, will serve to illustrate the

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adaptations which have been developed by this family in connection with their parasitic habits. On emerging from the pupal stage the insect, when its wings and body have hardened in the air, must seek a host on whose blood it will feed and on whose body it will dwell. For this purpose the wings are used ; but once established on the cattle these flies rarely use their wings except to move from one part of the host's body to another or to fly a short distance to another member of the herd. They cling in clusters to the softer parts of the body between the legs and beneath the tail. They move slowly and laboriously, often side-ways with crab-like motion. So far as is known the female deposits her single larva on the ground in places frequented by cattle. The larva is incapable of movement, and forthwith pupates, whilst the mother returns to the host to suck more blood and nourish another single larva. How many larvæ are thus successively produced is unknown, but probably they are comparatively few in number. This is one of the contrasts between this present family and other usually prolific Diptera. The ovaries are greatly modified. A single large egg is produced at a time and the larva remains in the distended oviduct. After extrusion the larva hardens by the excretion of chitin and it then resembles a small brown pea. Out of this emerges in due course another generation. There is no free larval life. Such is the cycle of life in *H. maculata*.

The structure of *H. maculata* is typical of many other members of the family. The flies are of middle size with oval flattened bodies of a tough and coriaceous texture. This is an adaptation which enables the parasite to apply itself closely to the host's body and to stand with impunity a certain amount of violence if the host tries to dislodge it. The head is small and not half the breadth of the thorax. The fly has a pair of large, oblong, compound eyes, but they are not prominent and the facets are notably small. There are no ocelli in this species, but some other Hippoboscids have simple eyes as well as the compound ones. The antennæ are extremely short. The first and second joints are indistinct while the third joint is round and bears a bristle-like arista. The thorax is broad. The abdomen is slightly hairy, compact and leathery so that the sutures between the segments are indistinct. The sexes can be readily distinguished by the shape of the abdomen which in the male is linear, shorter and narrower than the thorax ; in the female it is oval, longer and broader than the thorax.

We come now to the legs and wings which show modifications connected with a parasitic and sedentary life. The legs are rather short, very stout and slightly bristly. The two posterior pairs are fixed wide apart. The tibiæ are a little shorter than the femora ; the tarsi are half the length of the tibiæ. Each foot terminates with ungues or claws which are long, stout, curved and bidentate. The

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legs in fact have become modified so as to form organs for clinging rather than for locomotion.

The wings, on the other hand, are less strong than the normal Dipterous type. The costal vein extends about three quarters of the length of the wing and the sub-costal only half the length. Along the anterior margin of the wing there are a number of veins in close proximity, but the posterior part of the wing is weak and reduced. There are no veins to support and strengthen the membrane. When the wings are closed they are crossed like a pair of scissors and cover or conceal the abdomen of the fly.* The wings in fact are becoming atrophied as organs of locomotion.

The general colouring of these flies is brown, mottled, with yellow on the thorax and legs. They are found on horses, occasionally, as well as on cattle; but they can be distinguished from *H. equina* L. which is essentially a parasite of horses. *H. maculata* is an Indian or South Asiatic species. It was introduced into Madagascar with Indian cattle. During the Boer War it was introduced into South Africa in the same way and is apparently established there.

The travels of these parasitic flies in company with their hosts are illustrated in the case of *H. capensis* well-known in India and Ceylon as a pest of dogs. It is a fly of hot countries with habits somewhat similar to the last mentioned species. It is now found on the shores of the Mediterranean and down the East African coast as far as the Cape. There it has long extended its range into the interior. From Africa it also ranges eastward across Southern Asia as far as Korea and Japan. Such a geographical distribution can only be explained by man's action. We do not know the original habitat of this dog parasite, but it has evidently accompanied the friend of man in its travels with its master.

The Indian Hippoboscids which are found on birds are very imperfectly known but there must certainly be numerous species belonging to the two sub-families *Ornithomyiinæ* and *Olfersiinæ*. All forms of birds appear to be victimised and the parasites of the birds seem to be less particular as to their host than those which attach themselves to mammals. The same fly has been collected from widely different birds. The parasites migrate naturally with their hosts and certain species of these flies such as *Ornithomyia avicularia* L. are found almost all over the globe on all sorts of birds. On the other hand one genus of fly (*Stenopteryx*) is associated with the swallow-family and another (*Oxypterum*) with the swift-family. Why this should be we do not know at present, but may some day discover.

Streblidæ. The flies of this small and little known family are for the most part ecto-parasites of bats. One Central American species

* The reader will find a good coloured figure of *H. maculata* in "Indian Insect Life" by H. Maxwell-Lefroy, Calcutta, 1909 (Plate LXIX. fig. 7.) which will enable the above description to be followed.

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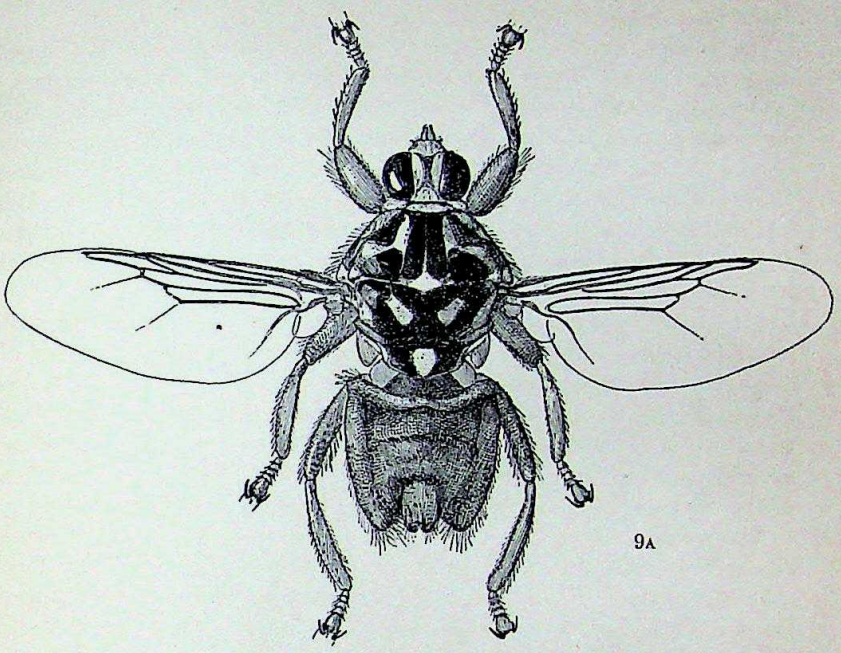
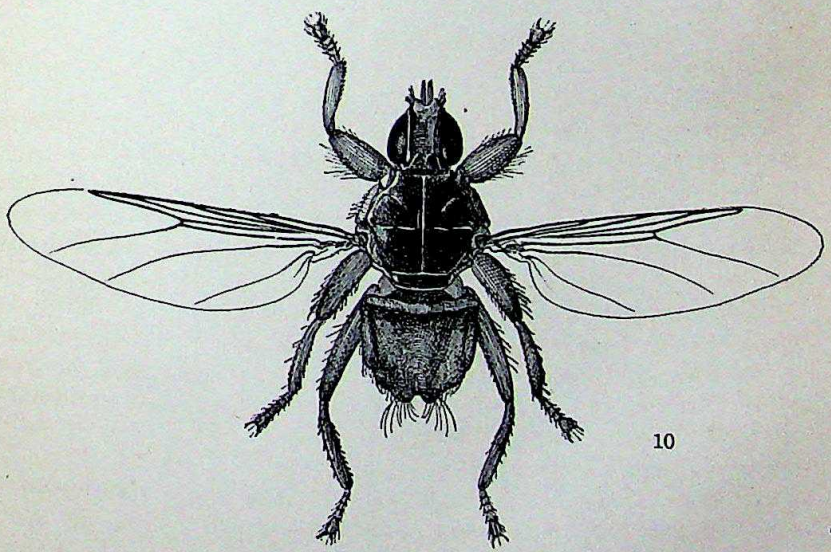


9A



10

INDIAN PARASITIC FLIES.

9A.—*Hippobosca camelina*, Leach, ♀. x 5.
10.—*Lynchia maura*, Bigot, ♀. x 6.

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is a bird parasite. They were separated from the *Hippoboscidæ* by Kolenati (1862) and seem to form a natural group between that family and the *Nycteribiidæ* which are more highly specialised and exclusively bat-parasites. They are, however, nearer the Hippoboscids and are probably descended likewise from Muscid ancestors but along another line of descent. Some are destitute of eyes; and where eyes are present the Streblids may usually be distinguished from the Hippoboscids by two fairly salient features. First, no Streblids have facetted compound eyes. Where the eyes are more than single ocelli they are formed by the agglomeration of several occelli. Secondly, in the Streblids the palpi do not sheathe the proboscis as they do in the Hippoboscids.

A Streblid fly can often be recognised at a glance by the flattened leaflike pair of maxillary palpi which project in front of the head. Kolenati was certainly wrong when he suggested that the larval Streblids fed on the excrement of the bats; they are pupiparous and their methods of reproduction are similar to those of the other families in that group. In some forms the legs are short and thick recalling those of the Hippoboscids; in others they are enormously long and attenuated, or spider-like, recalling those of the Nycteribiids. It is of interest to note, in this connection, the two contrary lines along which the legs of ectoparasitic Diptera have evolved from the normal type in flies, the object in both cases, of course, being to secure a hold on the host. Wings in Streblids are sometimes well developed, sometimes reduced and sometimes absent. They are never much used as organs of locomotion; and, where wings are well developed, they are covered with fine hairs which give a milky appearance rather unusual among flies. Where the wings are reduced, the wing venation is unlike that of the Hippoboscid wing, showing that reduction in this family has proceeded on other lines. Halteres are present but in the wingless species they are reduced. In many species of Streblid the halteres are protected by a projection of the thorax which may be regarded as an adaptation developed in connection with parasitic life to shield these delicate organs when the fly makes its way about the body of the host. The claws are always well developed; and in one species, which is quite wingless, there is an indication of an accessory tooth. This is another illustration of the tendency among parasites to develop organs of prehension when organs of locomotion are lost.

The abdomen in this family shows little sign of segmentation except at the base where it is united to the thorax. In the winged species, the wings are contrived to fold back fan-wise and lie flat upon the surface of the insect's back. With this, the arrangement of bristles on the dorsal surface of the abdomen seems to coincide; for there is a bare tract along the back where the wings are tucked away. On

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either side a row of stout bristles, with a pair of chitinous hooks on the first abdominal segment, shield them from injury when the insect is creeping through the hairs of its host. Some have also a row of stout bristles or spines arranged across the ventral surface of the abdomen which reminds one forcibly of the abdominal ctenidium in the Nycteribiids and which probably serves a similar purpose.

In the genus *Strebla*, Wied, from which the family is named there are at least four peculiarities which have been developed as parasitic adjuncts. First, there is a collar of many chitinous spines beneath the head which seems to be analogous with the ctenidium of Nycteribiids; secondly, there is a collar with a few similar spines on the dorsal surface at the back of the head; thirdly, on the surface of the head and directed forwards, there is a semi-circular plate with seven rows of spines below and two large ones above all directed backwards so as to facilitate progress forwards; fourthly, there are two grooves along the sides of the thorax which enable the very long pair of front legs to be tucked away when the parasite requires to protect them. The grooves are fringed along the margin with spines and are shaped to contain the tibial joint when the legs are folded. The front pair of legs are placed far in front of the middle and hind pair and are separated from them by nearly the whole length of the thorax. These extremely strange peculiarities in the insects' morphology are difficult to make intelligible to the reader by a mere verbal description. They are, however, clearly seen in the two well drawn and large plates at the end of Dr. Speiser's paper which contains the best general account of the flies of this family that has yet been written.*

Among certain Streblids of the genus *Ascodipteron* there is an extraordinary divergence between the male and female, both as regards appearance and life history. These insects are found in the Oriental region and may some day be obtained in India. The first member of this remarkable group was discovered in 1896 by Dr. Theodor Adensamer of Vienna who found a solitary specimen embedded in the wing-membrane of a bat which he had brought back from Java.† Dissection of the internal organs under the microscope showed it to be a female Dipteron reduced by parasitism to a shapeless lump. He rightly guessed that when the males were discovered they would prove to be free-living normal insects. We now know that the female is at first winged but imbeds herself in the bat, sheds her wings and legs and undergoes post-imaginal metamorphosis into a flask-shaped object. Her abdomen grows to such an extent that it surrounds and

* "Ueber die Strebliden, Fledermaus Parasiten aus der Gruppe der pupiparen Dipteren" by P. Speiser (1900) Archiv für Naturg. 66 Jahrg. Vol. I. p. 31. 2 Plates and Bibliography.

† T. Adensamer: "Uber *Ascodipteron phyllorinae* (n. gen. n. sp.) eine eigenthümliche Pupiparenform". (1896). Sitzungsb. K. Akad. der Wissenschaft. Wien, Vol. 105. Pt. I. p.400. 2 Plates.

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covers her head and thorax. The proboscis of the female is modified to enable her to cut into the skin of the host but the homology with the normal Streblid proboscis can be discerned. The following summary is based on the observations made by Mr. F. Muir, an American entomologist.* The adult flies emerge from the pupa-case which lies upon the ground in caves and other haunts of bats. Both sexes are perfectly normal flies with fully developed legs and wings. They are of a light reddish-brown colour with a pair of large rounded wings. Both sexes are destitute of eyes and only the male has maxillary palps or feelers. The most striking features in the female is the enormous size of the proboscis and the fact that head and thorax appear as though welded into one piece. But for this she has the normal appearance of a small fly and nothing suggests how she will end her days. The proboscis is a chitinous, broad, flattened, blunt cone with a base somewhat wider than the head. At the apex of the proboscis there arise fourteen rows of chitinous blades. They are like circular saws cut in half so as to form a row of semi-circles placed side by side.

There is a short gap in our knowledge of the life history but the pairing of the sexes probably takes place in a normal manner whilst the female is winged. The female then seeks her host and by theaid of the blades at the end of her proboscis cuts through the skin of the bat. The parasites were always found imbedded in the same position under the skin at the base of the ear. There were usually two, rarely three, but sometimes only one specimen on a bat. When she is imbedded the abdomen enlarges and engulfs the head and thorax so that eventually they lie at the bottom of a pit at the anterior end of the abdomen. The fly burrows into the bat head foremost and the posterior end of the abdomen remains protruding. The presence of the parasite makes itself visible as a swelling with a small pearly-white body protruding at one side thereof. When cut out of the host the parasite appears as a semitranslucent white flask-shaped body four to five millimetres long. No head or thorax is visible. Wings and legs are gone. How and when the female gets rid of them remains a mystery. The stumps can be detected but there are no traces of legs or wings in the cavity formed under the skin of the bat. The proboscis is so rigidly fixed to the head that it could not be used to sever wings or legs. They must, by some other means, be got rid of before the female insect is completely imbedded. In this dismal fashion she produces her larvæ which are born mature, fall to the ground and pupate at once. The male fly is not provided with adequate weapons on his proboscis to cut through the skin of a bat. He

* Muir found that at Amboina only one species of bat (*Miniopterus schreibersi*) was attacked by *Ascodipteron speiserianum* and that 28 per cent of the bats examined were infested. F. Muir: Two new species of Ascodipteron. (1912) Bull. Mus. Zool. Harvard, Vol. LIV. pp. 351-366. 3 Plates.

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remains external, enjoying a free and, let us hope, merrier life. He is a normal pupiparous fly in habits, structure and development similar to other Streblids. The reader who is an entomologist will at once think of an analogous case where the female of a parasitic insect buries herself in the flesh of the host, namely the jigger flea, *Dermatophilus*, of hot countries.

The distribution of the Streblids is not at all accurately known. *Nycteribosca gigantea*, Speis., has been taken off bats in the caves of Burmah. Two species of *Raymondia*, Frfld., have been collected in Madras. There must be numerous species in India if they were searched for, since bat parasites have been so little collected.

Nycteribiidæ. The members of this family are wingless flies parasitic on bats; and it follows that the ordinary person who does not make a special business of collecting bat-parasites is unlikely ever to come across them. The family is an extremely interesting one because of the extraordinary morphological modifications which the typical Dipterous structure has undergone under the influence of a highly specialised parasitic existence. These insects pass almost the whole of their lives on the bat's body and derive the whole of their nourishment from its blood which they suck at frequent intervals. The Swedish naturalist, Linnæus (1758), thought that they were lice. Latreille (1795) established the genus *Nycteribia*. This eminent French entomologist also saw that these insects were, in fact, wingless flies and not lice. The ordinary unlearned person might mistake them for small spiders, which they somewhat resemble both in form and in manner of movement.

The *Nycteribiidæ* have an almost world-wide distribution. Bats are found all over the globe except in the Polar regions. It would seem that all sorts of bats are at times infested with these parasites. An individual bat may harbour Nycteribiids belonging to two different genera; and several species of these insects have frequently been taken from the same species of bat. The migratory powers of the hosts are sufficient to explain the wide geographical distribution of these parasites. Nine different species of Nycteribiid have been collected from one form of bat which has an exceptionally wide geographical range. It is a well established generalisation that these bat parasites have their headquarters in the Old World and are most abundant in the countries which lie round the Indian Ocean. Speiser, who is again the greatest authority on the family, recognises some eight genera and between thirty and forty species.* The genus *Archi-*

* In his learned and painstaking paper there will be found a full bibliography of the literature down to 1901 and a summary of our knowledge of the group together with a revision of the family and a table to show the geographical distribution. See "Ueber die Nycteribiiden, Fledermaus Parasiten aus der Gruppe der pupiparen Dipteren." Von cand. med. P. Speiser. *Archiv fur Naturgeschichte* (1901) 66th yea Vol. I. p. 11.

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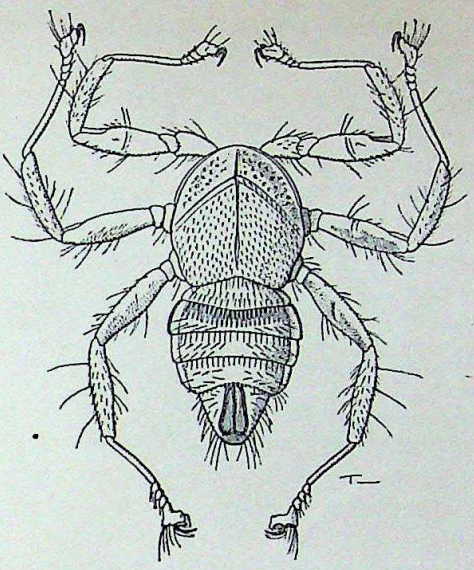
11



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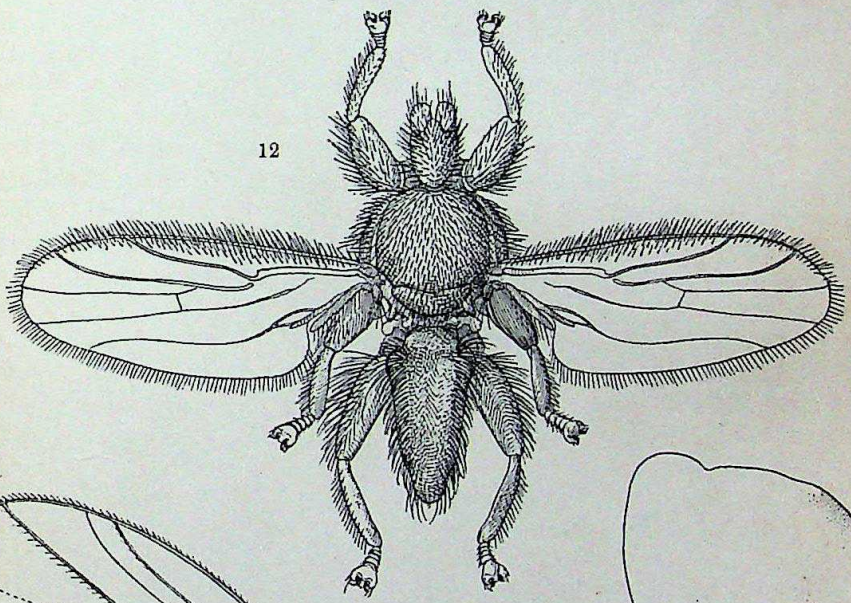

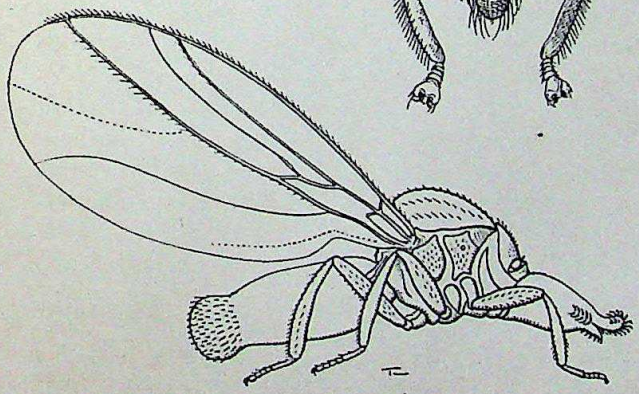

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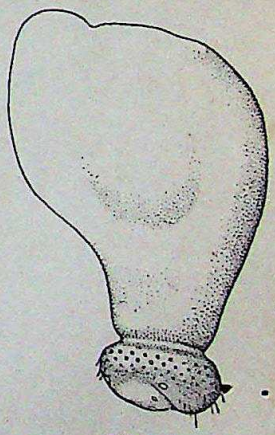

13A

INDIAN PARASITIC FLIES.

11.—*Nycteribia* sp. (after Sharp.) x 9.

12.—*Nycteribosca amboinensis*, Rondani. (From Biserat, Malay Peninsula.) x 22.

13.—*Ascodipteron speiserianum*, Muir ♀. (After Muir.) x 25.

13A.—*Ascodipteron phyllorhina*, Adensamer ♀. (After Adensamer.) x 10.

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nycteribia with a single species from New Guinea may represent an ancestral type: the first tarsal segment of the legs instead of being long and attenuated is exceedingly short and hardly so long as the three next segments put together; there is no ctenidium or comb on the underside of the abdomen.

No mere description can give more than a general view of the comformation of these remarkable Diptera.* There are no vestiges whatever of the front pair of wings but all species have halteres representing the second pair of wings. The retention of these stalked knobs in a group which does not fly is some confirmation of the belief that the halteres are not balancers but sense-organs. The separation of head, thorax and abdomen is clearly marked. The head is small and attached to the upper side of the thorax by such a slender and flexible neck that in dead specimens the head is often completely bent back. In such cases the back of the head rests on the thorax and the mouth parts are directed upwards to the heavens. It was at one time thought that Nycteribiids must turn over to feed but it seems uncertain whether this unusual posture of the head is ever adopted when the insect is alive.

The conformation of the thorax and position of the legs is also singular. The lower surface is strongly protected with a dark and horny chitin whilst the upper surface is soft and of a yellowish white. It is just the reverse of what one finds in other Diptera. The ventral plate of the thorax projects in front under the head and to the rear beyond where the abdomen is rooted to the thorax. But the oddity does not rest there, for the three pairs of legs are inserted on the upper instead of the nether surface of the thorax. In fact the ventral plate is prolonged round the sides of the thorax. In death the six legs are contracted together over the back instead of under the belly as in a dead house-fly. In life the insects seem to be running about upside down or with belly uppermost. Although their native heath is the furry skin of a bat, they can make good progress on a mahogany table.

The six legs of a Nycteribiid conform in general, as to structure, with those of other Diptera and all the normal segments are present: coxa, trochanter, femur, tibia, tarsus. The following peculiarities are note-worthy. First in every species of Nycteribiid the femur is marked with a ring or furrow of lighter coloured and softer chitin which would seem to increase the flexibility and reduce the rigidity of the segment; secondly, in two genera both of which are Indian (*Cyclopodia* and *Eucampsipoda*) the tibiæ are similarly marked respectively with two or three rings, as the case may be, which make the tibial segments more lissom; thirdly, the tarsi have peculiarities

* There is an excellent figure of a Nycteribiid in the Cambridge Natural History "*Insects*" and also in Mr. Hugh Scott's paper on these insects *Parasitology* (1917) Vol. IX. p. 593. The coloured figure in *Indian Insect Life* by H. Maxwell Lefroy, Plate LXIX, is too small to show the structure in detail.

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which are almost unique among insects. The tarsi are five-jointed and the distal joint is furnished with a pair of curved claws like grappling irons. The first tarsal segment is of immense length, very slender and occasionally bowed. It is capable of being twisted in every direction and in some species is actually longer than the tibia which is next to it. The result is to increase the prehensile power of the parasites when the bats move and to enable them to adjust their hold to any contortions of the hosts.

The abdomen is the bulkiest portion of the insect's body. That of the male is darker and more chitinous ; that of the female is soft, membranous and capable of distention. Both sexes have numerous bristles on the abdomen directed backwards and systematically arranged so as to be of some taxonomic importance. The total length of the body is from one to four millimetres. The largest species are parasitic on tropical fruit-bats. The majority of species are provided with ctenidia or combs such as are familiar to students of fleas and some other insects parasitic on mammals or birds. The combs are furnished with horny teeth and facilitate progress through or over the fur of the host. They may also serve to protect the joints of the parasite against the hairs of the host. All Nycteribiids (except the genus *Eremoctenia* which has no combs at all) have a pair of combs attached to the thorax in front of the insertion of the first pair of legs. Associated with the comb is a groove from which apparently it can be raised, or into which it can be depressed by special muscles, as occasion may require. The thoracic combs may have from 9 to 22 teeth. They are not, as was once thought, atrophied vestiges of a pair of wings but distinct organs evolved in connection with parasitic life. All Nycteribiids (except the two genera *Eremoctenia* and *Archinycteribia*) have a comb on the underside of the abdomen attached to the second segment. There are seven segments but the first is almost invisible.

Speiser in the paper alluded to above gives the following thirteen species as having been obtained in the Indian region where the Nycteribiids are represented by more species than in other geographical regions. Our knowledge is too scanty to lay down in detail the geographical distribution of the various forms.

Indian Region.

1. *Penicillidia ienynsi* (Westw.)
2. *P. euxesta*, Sp.
3. *Nycteribia minuta*, v. d. W.
4. *N. stichotricha*, Sp.
5. *N. roylei*, Westw.
6. *N. parvula*, Sp.
7. *N. allotopa*, Sp.
8. *Cyclopodia albertisi*, Rnd.
9. *C. horsfieldi*, de Meij.
10. *C. sykesi* (×Westw.)
11. *C. hopei* (Westw.)
12. *C. ferrarii* (Rnd.)
13. *Eucampsipoda hyrtli* (Kol.)

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There remain some further facts worth noting on the habits and structure of these dipterous parasites. Many species are destitute of eyes, and where ocelli are present, they are of such a simple kind that the insects' power of vision must be of the poorest description. The antennæ are only two-jointed and are protected by deep pits at the base of which they are inserted. On the under side of the head there is a narrow groove into which fit proboscis and maxillary palpi. All these characteristics are features frequently found in many ecto-parasitic insects. With them may be also mentioned prehensile legs with clawed feet, ctenidia or combs, and the absence of wings.

The pupiparous habit of the Nycteribiids was made known by J. O. Westwood (1835) and some recent observations on this have been made by keeping fruit-bats in captivity and watching the doings of their parasites. When the time for her labour arrived, the female insect hurriedly left the bats and sought a suitable place to deposit her larva. Under natural conditions this would be some part of the tree where these bats congregate. The larva is a minute soft yellowish-white maggot of oval shape and dorso-ventrally compressed. It does not move and is covered with a sticky substance. Immediately after parturition the female stood over the larva and pressed it down with her thorax, causing it to adhere to the place where it was laid. She then hastened back to the bat. The males were never seen to leave the bats but they doubtless travel in search of females. In some species the female Nycteribiid fastens her larva to the host by means of the adhesive exudation. The place generally chosen is near the junction of the wing-membrane and the bat's body. The larva at once assumes the shape of a puparium ; in half an hour it has hardened and darkened ; in 48 hours the transformation into a pupa is complete. The pupal stage lasts about a fortnight. For those species which deposit their larvæ in the haunts of their hosts and not on their bodies this is a critical moment. The perfect insect must secure a host or it will perish in about forty-eight hours. A newly emerged female *Cyclopodia* has been observed to begin to breed in about ten days. Ten larvæ were produced in twenty-nine days. For a fly this is not prolific and one may infer that mortality from failure to secure a host is not heavy. A high birth rate is not always a sign of prosperity nor of high evolution either in the vertebrate or the arthropod world.

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A SURVEY SEASON IN THE NICOBAR ISLANDS ON THE R.I.M.S. "INVESTIGATOR," OCTOBER, 1921, TO MARCH, 1922.

BY

MAJOR R. B. SEYMOUR SEWELL, I.M.S., B.A., F.A.S.B.,

Surgeon-Naturalist to the Marine Survey of India, and Superintendent, Zoological Survey of India.

(*With 4 plates.*)

"Do you know the pile-built village where the sago-dealers trade—
Do you know the reek of fish and wet bamboo?
Do you know the steaming stillness of the orchid-scented glade
When the blazoned, bird-winged butterflies flap though?
It is there that I am going with my camphor, net and boxes,
To a gentle yellow pirate that I know—"

Kipling.

On my return to India in the middle of September, 1921, I learnt that the R.I.M.S. "Investigator" was due to leave Bombay early in October and that our destination for the Survey Season, 1921-22, was to be the Nicobar Islands or, to be more exact, the central group of islands that encloses Nankauri Harbour. Prior to our sailing the Hon. Secretary of the Bombay Natural History Society begged me to contribute to the Journal an account of my experiences and I was rash enough to promise that I would do my best to comply with his request. I am, however, fully conscious that my contribution to the literature of this locality contains little that is new for, in spite of their remote and comparatively isolated position on the map, the Nicobar Islands are by no means a "terra incognita." Many reports and papers dealing with the islands and their inhabitants have from time to time been published and in 1902 a full and graphic description was written by C. Boden Kloss,* who spent some weeks, cruising round these and the neighbouring Andaman Islands. Moreover, to do full justice to this extremely interesting locality one needs to be something of a geologist and an anthropologist, in addition to having had far wider experience as a student of both land and water fauna and flora than I can lay claim to.

The R.I.M.S. "Investigator" reached Nankauri Harbour, where we were destined to spend the next four months, about noon on October 26th. As we approached our destination we passed several islands belonging to the group, running to the East of Choura, Teressa and Bompoka. We then entered Revello Channel between Camorta and Kachal. Continuing our course to the southward, we passed the narrow cliff-bound entrance to Expedition Harbour, at one time a place of ill-repute as it was the headquarters of the notorious pirate Captain Kidd, and finally we arrived off the western entrance to Nankauri Harbour. We were thus able at the very start of our labours to get a general impression of the different characters of the islands and to compare, for instance, the thickly-wooded slopes of Kachal with the open rolling grass-lands of Camorta.

Horsburgh† writing in 1836, describes Nankauri Harbour as follows:—

"Nancoury Harbour in lat. 8° 0′ N., long. 93° 41′ E., distant from the E. side of Katchall 4 or 5 miles, formed by a narrow channel that separates the Island Nancoury from the south part of the Island Carmorta, is very capacious and will shelter a large fleet of ships from all winds. Having

* "In the Andamans and Nicobars," published by John Murray, London.
† Horsburgh's East Indian Directory, Vol. II., 1836.

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an entrance at each end, one to the eastward, another to the westward, with soundings close to them, where ships may anchor occasionally, makes it very convenient and they may enter or depart from it in every month of the year. The western entrance, about one-eighth of a mile or 100 fathoms wide, is formed between two steep points of high land and the depths in it are generally from 27 to 35 fathoms; outside of it, a sand bank with irregular soundings from 6 to 12 fathoms, and patches of rocky bottom project a little way from the S. W. point of Carmorta. The eastern entrance is very little wider than the former, being contracted by rocky banks which line the shore on each side having 12 and 14 fathoms close to them and from 18 to 20 fathoms in mid-channel. .. .. The tide runs strongly with eddies through the Western entrance. The flood sets through the harbour to the eastward; but with very little velocity inside."

At the base of the cliffs on either side of the western entrance several of the larger rocks and boulders have been gradually eroded and now form rocky archways through which the surf rushes in a smother of white foam. Once past the narrow entrance the harbour widens out and indentations of the coast line form four subsidiary bays—Satellite and Octavia Bays on the northern side and Wasp and Spiteful Bays on the south. As we steamed slowly up the harbour we saw several scattered villages, each consisting of two or three huts with thatched roofs and built on piles just above high water mark on a patch of sandy beach. The site of a village is almost invariably rendered conspicuous by the presence of one or more tall, tapering bamboos, decorated at intervals with bunches of leaves and grass, which the inhabitants erect in the water a little distance in front of their huts. We eventually anchored in Octavia Bay not very far from the jetty that has been built out across the coral reef opposite the Government Agent's bungalow; to celebrate our arrival a union-jack was hoisted on the flag-staff on shore and shortly afterwards the agent himself came on board to report.

During the first few days of our sojourn we received a succession of visitors in the persons of the headmen of the neighbouring villages, who came, in accordance with the terms of their office, to report themselves and to offer such assistance as should be required, but in reality their chief object was to find out what they could obtain from us in the way of cigarettes, ship's biscuits, rum or spirits, etc., for, whatever they may have been in the past, under the present system of government the Nicobarese have become the most bare-faced and persistent 'cadgers.' Every headman, according to the Gazetteer‡, receives an annual gift from Government of a suit of clothes and he is instructed to don these whenever he reports on board Government ships. This custom dates back for many years prior to the British occupation of these Islands, for Busch†, in his journal of a cruise among the Nicobar Islands in the Schooner *L'Espiègle* in 1845, relates that "several natives, dressed in jackets, hats and trousers, came on board and some of them showed us badges of authority—as also several certificates—appointing them headmen of different villages." At the time of Busch's visit the Nicobars were under no administration. The badges and certificates that he refers to had been granted during the Danish occupation, which practically terminated in 1837. It was not till 1869 that the British Government undertook the control of these islands and it was during the thirty years of abandonment that piracy became so rife, over 27 ships being scuttled and the majority of their crews murdered by the natives during the period. There seems to be little doubt that the Nicobarese

‡ Imperial Gazetteer of India, Provincial Series, Andaman and Nicobar Islands, Calcutta, 1909.

† *Vide* Selections from Records of Government of India, Home Dept., No. XXVII., "Papers relating to the Nicobar Islands," Calcutta, 1870

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themselves took an active part in these piracies, though they were probably organised and directed by Malays, but even the oldest inhabitants now profess complete ignorance of such deeds when questioned regarding their unsavoury past.

During the early years of European administration the sight of natives completely nude or clad only in the most meagre of loin cloths appears to have shocked the susceptibilities of those in authority, so the fiat went forth and the unfortunate headmen were and still are compelled to make their appearance looking like nothing more than a gang of coolies from the purlieus of one of the big Indian cities. An old torn khaki shirt and shorts and a battered 'pig-sticker' topee, probably worn back to front, constitute the basis of his make up, while the scarcity of water and his own natural laziness and disinclination to perform the work of a dhobi provide the finishing touches! To one interested in anthropology the first sight of the Nicobar natives proves a great disappointment. It is only when one has got to know them better and has met them in the jungle or in their own villages, unrestrained by petty regulations, that one begins to realise that they are a fine race of men of splendid physique though their features are, from our western point of view, marred by the almost universal habit of betel-chewing that renders the teeth black and covers them with a coat of betel-stained tartar. Among the Nicobarese themselves, however, this is regarded as a thing of beauty!

The inhabitants of these islands, as they exist to-day, are the result of an admixture of many races. Most observers agree that the original stock probably came from Malay and many of their customs still show a distinct resemblance to those pertaining among the Dyaks of Borneo, but the simplicity of their marriage laws has resulted in an infusion of Indo-Chinese, Indian and Dravidian blood so that one finds individuals of widely different physical types. In many adults, though not in all, we find a certain degree of prognathism. This character is generally attributed to prolonged lactation during infancy and to the habit of sucking cocoanuts. How this latter cause ever came to be suggested I cannot conceive. The Nicobarese do not suck cocoanuts. In order to obtain the cocoanut-milk the native by a single blow of his sharp *dao* cuts off the top of the green cocoanut leaving a round hole about the size of a rupee, and the coconut-milk is then drunk. No suction whatever is required and one's chief difficulty during the process is to avoid having an involuntary bath simultaneously. It would be much more rational to attribute the broad flat nose to this method of drinking than to cite it as a cause of prognathism. The children are for the most part sturdy little youngsters and do not usually exhibit the same degree of prognathism that one notices in the adults, a fact which incidentally seems to be against prolonged lactation as one of the causes of this feature. Their chief characterstics are a protuberant stomach and a curiously flat occipital region of the head. This flattening is artificially produced by pressure of the mother's hand during early infancy.

A visit to one of the native villages is always heralded by a chorus of barks from several dogs for the most part of the typical 'pi' variety. These dogs are kept for hunting purposes and are used in chasing the wild pig with which these islands abound. The dogs are by no means too well fed and it is not unusual to see them dashing down on to the beach and even into the water to snap up small fish that have been chased ashore by some predatory enemy. They are as a rule well treated, though occasionally in some of the islands one is sacrificed and is then cooked and eaten, a proceeding that is of considerable interest since the dog is undoubtedly the totem of the tribe ¶. In their legends regarding the origin of the race the Nicobarese are stated to be

¶. For information on this point I am indebted to Mr. E. Hart, Assistant Commissioner, Car, Nicobar.

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the offspring of a man from an unknown country and his pet dog, and their present day dress is an attempt to imitate the canine characters; thus the two-horned head dress made of a strip of palm-leaf resembles the ears, the end of the loin cloth left hanging down behind represents the tail. While the so-called loin-cloth (*kissats*) which is conical in shape and is made of red cloth, fits over the private parts and projects forwards as a blatant imitation of the dog's penis.** In the villages round Nankauri Harbour, however, one seldom if ever sees a Nicobarese in his native costume. Communication with the outer world has introduced more civilized customs and it is only on rare occasions in their huts or in the jungle that one comes across individuals clad in only a scanty loin cloth.

Each native habitation consists of two huts. The chief of these is of a bee-hive shape with domed roof capped by a projecting spike, while the other is rectangular with a sloping roof. This latter is referred to by Boden Kloss as the "kitchen" but in my experience it is used partly as a store house and partly as a dwelling: most, if not all, the cooking is carried out on a clay fire-place in the larger bee-hive type of hut. Each hut is built on piles and underneath is a platform on which articles can be stored or on which the men sit and smoke during the heat of the day. Villages are usually situated close down to the beach and just above high-water mark at the head of a small sandy bay, though one that I visited on Trinkat Island, to the east of Camorta and just across Beresford Channel, stands back a little way and is almost completely hidden in trees. The selection of the site is dictated by the necessity of having a good landing place for the canoes. Occasionally the village is screened from view by an outlying mangrove swamp or by a small projecting promontory, but its position is always clearly indicated by the tall bamboos, decorated at intervals by bunches of leaves and grass, which are erected well out in the water in front of the village. The size of the village is roughly indicated by the number of such erections. There should be one bamboo for each family, but this is not always accurately carried out. In certain other islands of the Nicobar group these bamboos seem to have a definite superstitious significance and are erected in the belief that they will bring good luck to the inhabitants of the village in their fishing; but in Nankauri Harbour they are regarded merely as land marks. True scare-devils of various kinds are, however, sometimes erected in the water in front of the villages, though in Nankauri Harbour I only saw one where this was done. This was at Inuanga on the east shore of Spiteful Bay. Some of these scare-devils took the form of a rattan or piece of wood placed upright in the water and split at the top longitudinally, while below it was decorated with a bunch of leaves and grass. Others took the form of human heads, decorated below with palm-leaves and grass: these were erected in groups of three. In the group which I photographed the central figure wears a top-hat, while the two side figures are crowned with a head dress terminating above in two white points.

Each Nicobarese family is the proud possessor of a certain number of domestic animals in addition to the dogs already mentioned. Fowls scratch up the sand and pick up what they can in the way of food, and below the dwelling house, on the platform mentioned above, one usually finds boxes and cane baskets in which the eggs are laid and there is usually at least one broody hen patiently hatching out a clutch. Pigs of all sizes, from full-grown sows to little "sqeakers", root about in the neighbouring jungle and fore-shore, picking up unconsidered trifles, and occasionally make a dash for and in one gulp despatch a stray small chicken. In addition to what they glean for themselves the pigs are fed daily, their allowance being two cocoanuts apiece: each housewife knows

** This costume is in its complete form best seen at the Northern Island of Car Nicobar.

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her own and woe betide any strange pig that tries to intrude during the feeding process. Finally one usually finds one or more cats busy washing themselves or lying in the sun near the entrance to the hut. Entry to the living hut is effected by means of a short bamboo ladder or by steps cut alternately in the two sides of a stout piece of timber. On Chowra Island as well as in Great Nicobar the Nicobarese use a large flat sponge as a door mat, on which they wipe their feet before entering the hut.* These sponges are found growing on the coral-reefs round those islands, but I saw none either growing or in use in the villages round Nankauri Harbour. The contents of a hut remind one irresistibly of a museum. At the far end of the hut opposite the entrance is an earthen or stone fire-place, upon which rest various pots and pans of earthenware; the rest of the space is largely occupied by "scare-devils" of every conceivable and inconceivable variety, some being crowded together in corners, others being suspended from the roof, while occupying a central position one frequently finds a red cloth-covered board, on which is displayed an amazing assortment of cheap German-silver or nickel-plated spoons, etc., obtained from traders in exchange for cocoanuts.

In spite of all efforts to christianise the inhabitants of the central group of islands their religion remains unchanged and is fundamentally and essentially animistic. They have an implicit belief in "spirits", for the most part, so far as I could gather, evil in character, that have the power to cause misfortune or sickness, but which can be kept away or driven out of the afflicted person by objects of a supposedly terrifying nature. A study of these "scare-devils" gives one a very good idea of both the history and natural history of these islands. The accompanying photograph shows a collection of these objects, all taken from a single hut, together with their proud possessor. The majority of these scare-devils can be divided into two groups:—

(a) Models of human beings and

(b) Paintings on wooden boards or shields.

On the left of the photograph stands the principal scare-devil (*kareau*), a life-size model of a Nicobarese medicine-man. As is invariably the case, the attitude is threatening and to make the resemblance complete the face is painted red and round the neck is hung a string of grass, ornamented with bits of cloth and glass beads. When in its proper place this figure usually stands at the head of the ladder and close to the entrance to the hut. On the right of the photograph is a three-quarter life-size figure of a Nicobarese woman, also in a threatening attitude and with vertical bars of white paint on the cheeks and chin. The squatting female figure in the centre is interesting, as it is in my experience of a very unusual type; the attitude, the legs crossed and the sole of the upper foot turned upwards, the left hand outstretched and the right hand raised, reminds one forcibly, in spite of the sex, of a statue of Buddha in the attitude of blessing, and to render the similarity yet more complete there is a painted caste-mark in the centre of the forehead. The fourth little figure with the peaked cap, buttoned-up coat and trousers is in a probability an image of one of the officers of the Austrian frigate "Novara" which visited these islands in 1858—at any rate the little man has been adorned with a very fine "kaiserlich" moustache. One of these scare-devils is of a most unusual type. Apparently it is intended for a model of a boat, but both stem and stern terminate in a four-faced head crowned with a top-hat and each bears a ring of spikes radiating outwards; seated in the boat are five little figures, each wearing a hat of the 'boating-straw' type with a black band.

* *Vide* Census report by A. R. S. Anderson, Census of India, 1901, Vol. III, Andaman and Nicobar Islands. pp. 163-169. Calcutta. 1903. *and* Dr. A. M. Meerwath. Ethnological gallery Guide Book, No. 2. "The Andamanese, Nicobarese and Hill Tribes of Assam," Indian Museum, Calcutta, 1919.

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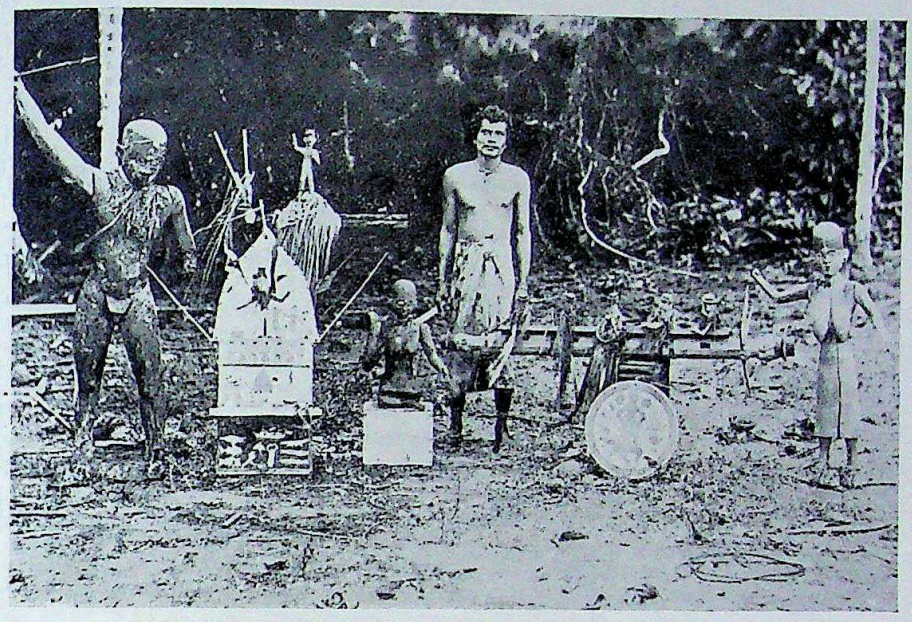

SCARE-DEVILS FROM A SINGLE HUT.

INUANGA VILLAGE IN SPITEFUL BAY SHOWING THE TWO TYPES OF HUTS AND NUMEROUS SCARE-DEVILS.

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The two painted shields (*Hentakoi*) are used in curing cases of sickness which according to the Nicobarese is the result of being 'possessed' by an evil spirit. In the majority of cases the scenes portrayed on these boards are painted in a series of parallel rows, as in the case of the left hand example. The upper portion of the shield is adorned with a large central figure of the Creator, usually portrayed as a European, dressed in coat and trousers or a skirt-like garment, possibly intended for a cassock. and a wide-brimmed hat. Occasionally he carries an umbrella. This figure is an undoubted survival of missionary teaching and is only found on boards painted in the central group of islands. Around this figure are shown most of the necessary household implements, water-pots, fishing-spears, knives, etc., emblems of headmanship, and almost invariably a table covered with a table cloth and furnished with all necessary materials, such as bottles and glasses, for a drunken debauch—the Nicobarese ideal of a really good time and termed by him "making Christmas." Below this there is usually a row of men and women dancing and then follows a picture of a native hut with all the domestic animals, a cow, a pig, and a hen, and on some boards a native canoe: in the hentakoi in the photograph there is a perfectly recognisable Imperial Pigeon, *Carpophaga œnea insularis*, with its dark body, wings and tail and pale gray head and neck. The bottom row of all comprises the sea and all that is therein. Among the animals portrayed here one can recognise a sting-ray, a shark, a crocodile, a dugong, a gar-fish and a *Triacanthus*, showing that the Nicobarese are well-acquainted with these animals, and the inclusion of the last two among the other dangerous animals further indicates that these natives are aware of the poisonous character of the dorsal spine of the *Triacanthus* and the possibility of injury being inflicted by the gar-fish when it leaps out of the sea. Such knowledge, however, is not surprising when one considers how much of their time is spent either on the reefs or in their canoes when fishing.

Almost the only means of communication between villages is by water, though occasionally one finds a narrow path cut and kept open though the jungle in order to save a long detour round the coast. The native canoe, of which there is only one type in use though the size may vary very considerably, is shaped and hollowed out by hand from the trunk of a tree. Although the shaping is done entirely by eye, it is extraordinary how graceful the lines are. When the cutting out process is complete, the canoe is first sunk in the sea and left to soak and then finally both inside and outside are burnt and any cracks stopped up by means of rag and crude tar. Finally a long straight beam of wood is fixed as an outrigger by means of two short bamboos, and planks or short lengths of bamboo are lashed on to form seats. A mast and light sail are sometimes used if the wind is favourable, in which case the mast is stepped on one of the thwarts, but more often the canoe is propelled by paddles or, when in shallow water, by means of a pole. In addition to the ordinary canoes a village may possess a large ceremonial canoe, capable of seating eight or ten people, and on festival days these are decorated with short bamboo uprights hung with flags and bunting while the occupants dress themselves up in top-hats or other types of head-gear made specially for the occasion. The canoes when properly managed are comparatively stable craft, but they are by no means uncapsizable, as Boden Kloss states, as we learnt to our cost on one occasion. A party of five of us had gone up Alligator creek and on our return, when near the mouth, a pigeon was shot and fell into the water just inside the fringe of mangroves. In his keenness to retrieve the carcase our Navigating Officer essayed to go over board after it, and stepping on the edge of the canoe completely capsized the craft and all its contents! Fortunately the water was shallow and we managed to bale out the water and retrieve various object from the muddy bed of the creek. Had we known at the time, what we subsequently learnt from the natives, that crocodiles are by no means uncommon in

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that vicinity, we should have regarded the episode in a somewhat less light-hearted manner; and incidentally had the only 'land-lubber' present been the culprit he would not have been allowed to forget it for many a long day!

The Nicobarese to a certain extent use fish traps, consisting of baskets made of split rattan cane, but, in Nankauri Harbour at any rate, fish are usually speared, either from a canoe or by the men wading in water up to their waists. Whenever a fish is 'spotted' the man slowly and quietly approaches until he is within striking distance and then hurls his fish-spear, which is armed with five or six barbed iron prongs. The usual result is a clean miss, but occasionally a good-sized fish is struck and captured.

As one would naturally expect in a race that lives and moves and has its being by the sea, the children's games largely consist in imitating their parents' chief occupation, and in most families we find that the youngsters are the proud possessors of toy boats, some of them being models of the native outrigger canoe, while others are crude models of either the *sampan*, carried by the Burmese or Chinese Trading craft, or the pulling-cutters and whalers of British ships. Occasionally these models are fitted with masts and sails and one not infrequently finds one riding at anchor a few feet out from the beach.

The Andaman and Nicobar Islands are, as a study of the contours of the ocean bed clearly shows, the top-most peaks of a great mountain range that has a height of approximately 15,000 feet, for on either side of the chain of islands the sea-bed rapidly sinks to a depth of 2,000 fathoms or more. This great mountain chain, which is a continuation of the Arakan Hills of Burma and links on at its southern end with the mountains of Sumatra, is supposed to be a part of the great Alpine-Himalayan system that was gradually thrown up during the Miocene and early Pliocene periods. There are two breaks in the continuity of the ridge, which extends in a curved line for nearly 700 miles. The northern and lesser gap separates the Andamans from the Nicobars and is known as Ten-Degree Channel, in which the depth of water is about 550 fathoms. The southern break, or the Great channel, separates the Nicobars from Sumatra, and here the depth of water over the ridge is nearly 800 fathoms. According to Professor Suess* the whole of the Andaman Sea was at one time dry land and formed a continuation to the south of the present basins of the Irrawadi and Sitang Rivers. If this be so, then the whole of the Andaman-Sumatra ridge must have formed one connected mountain chain and have been continuous with the main land. To geologists the subsidence or elevation of a small area of the earth's crust through a distance of 10,000 feet is a minor affair, when compared with such colossal convulsions as those which gave rise to the appearance and subsequent disappearance of huge areas of surface such as the theoretical continent of Gondwana land. From a study of the Mammalian and Avian fauna of the Nicobars and Andamans Boden Kloss reached the conclusion that these islands have never either been part of the main land or in any way directly connected with it. On the other hand the presence of numbers of Reptilia, the occurrence of numerous land and fresh water molluscs, which according to Godwin-Austen show an undoubted affinity to the molluscan fauna of Burma, and the presence of fresh-water crustacea, such as *Palaemon* and *Caridina*, seem to me to indicate that there must have been a connection with the main land and that this was followed at some later period by an almost, though not quite complete, submergence. This appears to have been followed in turn by a second period of elevation, which, so far as one can judge, is still progressing.

The geological formation of all the islands directly or indirectly connected with Nankauri Harbour, namely Nankauri, Camorta, Kachal and Trinkat, shows that at one time this area was almost, if not entirely, submerged. The

* Suess, "The Face of the Earth," Vol. I, English Authorised Translation.

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various deposits that make up the whole facies have, with the exception of a double outcrop in two parallel lines of true rock, been laid down at some period or other, probably in Eocene times, beneath the surface of the ocean. Camorta and Nankauri Islands are for the most part composed of clays that are in places so hard that they have all the appearance of rock. Tipper* has shown that these clays are generally found near igneous rocks and seem to be a product of their decomposition. The rock-like appearance of these masses of hard clay is specially well seen in certain parts of the coast line, where the cliffs have fallen away and the resulting debris now lies as large boulders on the fore-shore, or where denser bands of this deposit still resist the gradual wearing away by winds and tides and now run in ledges and shelves, exactly like those of a rock reef, out from the shore. This latter condition is particularly well seen at Naval Point on the eastern entrance to Nankauri Harbour, where a small headland juts out into the sea. The fauna of the clay masses is an interesting one. From the similarity of their appearance to true rocks one would expect to find them encrusted with Rock-oysters and Barnacles and serving as a habitat for such molluscs as limpets and *Chiton*. But as a matter of fact all these are conspicuous by their absence and instead we find that the boulders are bored through and through with the tube-like dwellings of *Pholas* and associated with the mollusc in these burrows one not infrequently comes across Turbellarian worms, while numerous brown-coloured actinians occupy pock-like pittings on the surface. Underneath these rocks and boulders I found a large assortment of animal life. Flat little Porcellanid crabs, that rapidly dropped off the boulder and scuttled away to another shelter, were of frequent occurrence, and numerous other crabs, such as *Leptodius* sp., were found half buried in the underlying mud. In certain areas one could usually manage to find an example of a Gephyrean, apparently belonging to the genus *Thalassema*, with chocolate-brown body and long yellow proboscis. Polychaet worms and Turbellarians were also by no means uncommon, while small Amphipods were ubiquitous. Not infrequently the lower surfaces of these clay masses were encrusted with sponges of brilliant hues, red yellow and blue being the prevailing tints.

Dr. von Hochstetter †, of the Austrian frigate "Novara" which visited the Nicobars in 1858, was the first to point out that there is a very distinct correlation between the geological formation and the type of vegetation of these islands. I have already referred to the difference between the well-wooded slopes of Kachal and the open grass-lands of Camorta, and the cause of this difference is to be found in the fact that Kachal is composed of limestone and corresponds, as regards its geological features, to the southern islands of Great and Little Nicobar, whereas with the exception of two bands of upper cretacious rocks, one forming the north-east coast of Nankauri Island and the other extending in a discontinuous ridge along the west coast of Nankauri and Camorta Islands,—being interrupted at the entrances of Nankauri and Expedition Harbours—almost the whole of Nankauri, Camorta and Trinkat Islands are composed of a sterile magnesian clay.‡

During the process of upheaval from its original submarine level to its present altitude the clay strata have in many places been folded and contorted. Along the northern shores of the eastern entrance to Nankauri Harbour the exposed

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* Tipper, G.H., "The geological formation of the Andamans with references to the Nicobars." Records of the Geological Survey of India, Vol. XXXV, Pt. 4, p. 13, Calcutta, 1911.

† Hochstetter, Dr. von., "Contributions to the Geology and Physical Geography of the Nicobar Islands." Selections from Records of the Government of India, Home Dept., No. LXXVII.—Papers relating to the Nicobar Islands, Calcutta, 1870.

‡ *Vide* Tipper, "The geological formation of the Andamans with references to the Nicobars." Rec. Geol. Survey, India. Vol. XXXV, Pt. 4, Calcutta, 1911.

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section shows a trough or saucer-like folding, so that at each end of the section there are grass covered headlands: Battery and Ray Points on the west and Naval Point on the east of the section. Between these points is a stretch of low-lying land composed of coral debris and marine alluvium, and, as Hochstetter pointed out, this serves as an admirable basis for the growth of many cocoanut-palms and screw-pines. Across the other side of the channel on the north-east shore of Nankauri Island the same bending of the clay strata is discernible, though here it is cut short on the east by the outcrop of true rock, which forms the headland, Reed Point. In both cases we find that the eastern-most end of the clay stratum is characterised by the interpolation of a bed of conglomerate and there seems little room for doubt that originally the deposits were continuous. In places where rain has washed away the surface soil and has formed irregular gullies and water courses, this magnesian clay can be seen to be of a yellow-ochre or brick-red colour, and, when dry, it hardens and cracks into small irregular blocks, like a child's toy bricks. As a result of this clay formation the greater part of these islands, and more particularly the higher levels and interior, consists of open grass-land with here and there patches of bracken fern and the low growing sensitive plant *Mimosa pudica*. This latter plant, which is now nothing but a weed-pest, appears to have been introduced accidentally, during the time of the last British occupation, in sheep fodder from the Andamans. Scattered about the slopes are screw-pines (*Pandanus odoratissimus*) that are, however, only miniatures of the trees which grow in more suitable soil. This type of scenery has been termed 'park like' but the similarity of appearance is superficial rather than real, for in this case the open spaces are due, in the main at any rate, to the sterility of the soil, though in a lesser degree they are maintained by human agency, for the Nicobarese periodically set fire to the grass, thus destroying any shrubs or young trees that may have obtained a foot-hold. Anderson§ indeed, goes so far as to deny that it is the sterility of the soil that produces the open grass lands and attributes their presence entirely to this periodical burning, and, in support of his view, he states that on Teressa the natives enclose parts of this clay land and form fertile gardens, while in places the line between grass-land and primaeval forest is much too straight to be attributed to changes in the geological character of the soil. In some of the smaller ravines and valleys, and especially in the neighbourhood of patches of primaeval forest, one sometimes comes across an area dotted over with low bushes that gives one the impression that it was originally a garden but has since been abandoned and allowed to run wild. Frequenting these spots one usually finds a number of small birds, conspicuous among which are brightly coloured bulbuls and little flycatchers. The grass that covers these lands is of an extremely coarse kind, known as 'lalang' or thatching-grass, and it attains to a height of two to three feet. Incidentally it has an extremely sharp edge and when drawn across the skin causes a cut that, though usually not deep, can be extremely painful. Coarse though the grass is, it serves to support quite a respectable herd of wild cattle, the feral descendants of the domestic herds maintained by the missionaries in the old days or introduced during the period of occupation by the Penal Settlement from 1869—1888. These cattle roam about usually in small parties consisting of one bull, one or two cows and often several calves of various ages. At the time of our stay in Nankauri Harbour a gang of convicts from the Penal Settlement in Port Blair, under the charge of a few Indian Police, were engaged in clearing away the jungle from the south end of Camorta. The passion of Indians for milk needs no emphasis and the manner in which the cravings of these men were satisfied was as follows:—a small herd containing a young calf would be carefully marked down in a small area of open land, and

§ Anderson, A. R. S, "Diary of a visit to the Nicobars for census purposes" Census of India, 1901, Vol. III, pp. 163-164, 1903.

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five or six men would gradually surround the herd, quietly working their way closer and closer without disturbing the animals. Eventually the herd would take fright and bolt, but with a wild final rush the men would usually manage to secure the young calf. This was then tethered to a stake on the spot and left there. After a time the mother cow would return to feed the calf and each day the little animal was moved nearer to the convict camp. Eventually the cow was thus lured into the camp and submitted to being milked.

As a natural corollary to the presence of a herd of cattle the grass-land was swarming with ticks, but the numbers present seem to show a distinct seasonal variation. During the wet months, November-January, each time our dogs were taken for a run on shore they came back infested with dozens of these parasites, but as soon as the comparatively dry weather set in, about the middle of February, there was a marked diminution in their numbers.

One's first impression of the fauna of these islands is that of comparative paucity. In addition to the wild cattle there are also numbers of wild pig, and Miller¶ on the evidence of the skin and skull of a young adult male and the skull of another older male, has created the species *Sus nicobaricus*. According to Abbot, whom Miller quotes, this wild pig of Great Nicobar is different from the domestic one and is smaller in size ; but one should keep in mind that the natives of these islands only keep the sows. Any boars in a litter are turned adrift into the jungle where they fend for themselves. The sows on the other hand are carefully tended and fed daily and one would naturally expect them to attain to a greater size than the wild examples. Moreover all the sows are fertilized by wild boars and it is difficult to see how two true species could be maintained under these conditions. Certainly during my wanderings on Camorta or Nankauri all the wild pig seen by me appeared to be uniform in character with the domestic ones. The only other land mammal known from these islands is the rat. Thanks to "Sammy"—the Captain's dog—I managed to obtain a specimen from Camorta. A second example was seen, but, though Sammy again did his best, we failed to secure it. Both these rats were living on the grassy uplands at the back of the old settlement site. The government agent, Mewa Lal, told me that large rats used frequently to come down to the jetty near his bungalow at night to feed on the shore crabs. I neither saw any myself nor succeeded in procuring a specimen, but the agent's story was corroborated by our own Tide-watchers, who were living on the jetty, and according to their account the rats were large and in size resembled a bandicoot ; possibly they were examples of the shrew, *Crocidura nicobarica*, Miller, a species obtained by Abbott and Boden Kloss from Great Nicobar. The only other mammal seen in the neighbourhood of these islands was a small bat—probably *Miniopterus pusillus*, Dobson. Every evening at sun-down during the later months of the year numbers of these little creatures could be seen flying across Nankauri Harbour from the south-west towards Camorta. During January and February the numbers of these bats that were seen showed a marked diminution. Possibly during these months they migrate elsewhere or it may be that their evening flight occurred later in the day and so was not noticed. I managed to secure a couple of examples, though I hesitate to say how many cartridges were vainly expended by myself and my shipmates before we were at last successful ! One of the Forest Officers of the Andamans, Mr. Bonnington, who spent some months in this neighbourhood studying the flora, tells me that these bats live in limestone caves in Kachal Island and nightly cross over Revello Channel and Nankauri Harbour to Camorta. The presence of these bats in the caves on Kachal has been recorded on several occasions. Thus Anderson writing in 1901 remarks. "The bats (*Miniopterus schreibersi*), which Ball noticed in this cave thirty years ago, are still there in

¶ G. S. Miller Jn., "The mammals of the Andamans and Nicobar Islands," Proc. U. S. Nat. Mus., Vol. 24, p. 755, Washington, 1902.

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large numbers." The cave he refers to is in weather-worn coral limestone at a height of 200 feet above sea-level.

Other inhabitants of the grassy uplands are numerous, wagtails and pipits and one could usually be certain of putting up a few little quail, belonging to two different species, *i.e.*, the Blue-breasted Quail, *Excalfactoria chinensis*, and the Nicobar Button-Quail, *Turnix albiventris*, whose crops seemed invariably to be full of grass-seed.

It would be out of place in a paper such as this to review the past history of the Nicobars and the various attempts that have been made since the 17th century to christianise the inhabitants or to colonize the islands. In every case the effort has proved to be a failure and the attempt has been abandoned ; but traces of former occupations are plentiful and this is especially the case on Camorta near the south-eastern corner, where the British Penal Settlement was located. During the period of occupation a regular little town must have existed here and one can still see numerous traces of its former greatness. Both east and west of the jetty a low sea wall that forms a habitat for the terrestrial Isopod *Ligia*, has been built of coral blocks, cemented together and at intervals this wall is interrupted by the exit of "pucca" drains designed to carry off the storm water from the settlement area. In the little ravine at the back of the Agent's bungalow is a large water-reservoir and two brick wells, while higher up on the slopes and summit of the rising ground one finds remains of the foundations of bungalows and portions of brick walls, now overgrown with ferns and with great trees rising from among the displaced bricks. Traces of roads and paths made of broken coral can still be found but nature is doing her best to hide these evidences of past failure, and the jungle has gradually encroached inwards. During the period of occupation, and especially that part of it when Mr. E. H. Man was in residence, numerous trees and shrubs were introduced and in consequence the character of the jungle in this part of the island is very different from what one finds elsewhere. Two large avenues of Casuarina trees lead up from the jetty through the jungle, bordering what were evidently at one time main roads, and a number of fine trees, belonging, so far as I can judge, to the genus *Albizzia*, form the predominating feature of the upper slopes. These latter trees have wide spreading branches and form a large umbrella-shaped dome that gives, when in full leaf, plenty of shade. During late January these trees begin to shed their old leaves and early in February they were in full flower, being covered with pink blossoms. The presence of these trees produces a curious effect on the jungle, for at sundown the compound pinnate leaves all fold up and droop, exactly after the manner of the leaves of the sensitive plant when they are touched, thus giving one the impression that the trees are dying and the leaves becoming withered. Yet next morning at sunrise they are again obviously flourishing and every leaf is wide-spread.

As one follows the path over the brow of the hill one comes out on open grass land intersected by ravines and nullahs, and on the right of the path, and a little below it, is a little artificial lake that has been formed by throwing a bund across one of these ravines. In the course of years this has become populated by a flora and fauna. Water-lilies are growing on its surface and living in it are fish of the genus *Eleotris*, fresh water prawns of the genus *Palaemon*, and a few examples of a mollusc of the genus *Neretina*. In addition there are numerous insect larvæ and water beetles. Swallows flit backwards and forwards over its surface, occasionally dipping down to the water, and near by a small flock of the Little Egret (*Herodias garzetta*) can usually be found perched on one of the trees. A chorus of loud croaks indicates the presence in the grass bordering the lake of numerous frogs but I only succeeded in obtaining a single specimen which appears to belong to the species *Rana erythræa*.

During the occupation of the island two other large ravines were apparently under rice cultivation and bunds, provided with sluice-gates, were construc-

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ted across their mouths close to where they open into a large mangrove swamp on the east side. Traces of these bunds can still be seen. The low-lying area forms an excellent snipe-ground during the cold weather, and one could nearly always depend on finding several couple of the Pin-tail Snipe, *Gallinago stenura*. In addition to these comparatively large nullahs, numerous small ravines run down from the higher ground to the sea. During the rains these become true water courses and serve as a habitat for three species of operculate fresh water molluscs belonging to the Neritidae and Melaniidae. It is interesting to note that such widely distributed non-operculate genera as *Limnæa* and *Planorbis* (including *Indoplanorbis*) are conspicuous by their absence. Even the only two land snails that I came across belonged to operculate genera. In view of the amount of rain that falls annually, namely some 120 inches, and its comparatively uniform distribution throughout the year— March and April being the only dry months—this marked predominance of operculate forms is extremely interesting. It cannot be accounted for by prolonged periods of drought that would tend to kill off all non-operculate forms, and it suggests that it is this character that has facilitated the transport of these forms from distant coasts of Burma or Sumatra.

In one low-lying area, through which a small stream ran a tortuous course, I found several examples of *Palæmon* and two specimens of what appears to be a species of *Caridina*: in addition a few young fish, *Eleotris* sp., were also obtained. All these ravines served as a habitat for the Pin-tail Snipe, *Gallinago stenura*, and not infrequently one saw the White-breasted Water-hen, *Amaurornis insularis* Sharpe, but the numbers present were always small.

All along the eastern and western sides of Nankauri and the west side of Camorta, where the geological formation consists of true rock, and in smaller patches in other parts of the islands where the soil is suitable, one finds a dense growth of primæval jungle with occasional cocoanut palms and Pandanus trees, the whole laced together with creepers that in places form a dense green blanket spreading from tree-top to tree-top, while on the ground level a thick growth of rattan cane and creeping bamboo renders progress almost impossible. The Pandanus tree appears to be able to grow in almost any locality. I have already mentioned that it is almost the only tree that will grow on the sterile clay-land —a power that it shares with the Casuarina—and near the entrance to Expedition Harbour several small and stunted examples are maintaining a precarious foot-hold on a narrow ledge of rock only a few feet above the sea. It is in the primæval jungle or in special plantations that we find the enormously tall Pandanus trees that Roxburgh* refers to in his work on Indian plants. He there gives the height of these trees as thirty-five to forty feet, but in the jungle I have seen them considerably taller than this and, indeed, there seems to be no limit to which they cannot attain. The extension upwards seems to be an adaptation to the surroundings, for unless the tree can rise to the level of or above the immensely tall forest trees of the primæval jungle it will be completely deprived of sunlight and hence will die.

In the neighbouring island of Kachal numerous monkeys are to be found, but I never saw any nor so far as I know have any been recorded from Camorta or Nankauri. In these islands the chief inhabitants of the primæval forest are enormous numbers of Pigeon. The commonest of all is the Nicobar Imperial Pigeon, *Carpophaga ænea insularis* (Blyth); though very often difficult to see owing to the thickness of the foliage, its deep low coo betrays its presence everywhere. Associated with these birds, and hardly to be distinguished from them until they have been shot and examined carefully, are a few examples of the Andamanese Wood-Pigeon, *Alsocomus palumboides* (Hume). Far less common than the

* W. Roxburgh, "Flora Indica or Descriptions of Indian Plants," p. 707, Calcutta, 1874.

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Nicobar Imperial Pigeon, and keeping much more to the low-lying parts of the jungle and the mangrove swamps, are small flocks of the Pied Imperial Pigeon, *Myristicivora bicolor* (Scop.) : while the Nicobar Pigeon, *Calœnas nicobarica*, (Linn.), was comparative rare. The distribution of these different species seems to be to a certain extent local : for instance the Imperial Pigeon were common on Nankauri Island but were comparatively rare on the south-east corner of Camorta, though their numbers increased as one went northward towards the head of Grand Harbour ; and the Pied Imperial Pigeon were comparatively rare on Nankauri Island and round the site of the old settlement on Camorta but were very common further north round the entrance to Expedition Harbour. From time to time flocks of the Andamanese Green Pigeon, *Osmotreron pompadora chloroptera* (Blyth), were seen feeding on certain trees in the jungle. The Andaman Cockoo-Dove, *Macropigia rufipennis* (Blyth), was by no means rare. In the Andamans the flesh of this bird is said to have a peculiar and somewhat pungent flavour that renders it unsatisfactory as an article of diet, but our experience in the Nicobars was the exact opposite. The presence of this bird in the bag was always welcomed, as we found it extremely pleasant to eat with a flavour distinctly superior to that of the larger Pigeon. A few examples of the Bronze-Winged Dove, *Chalcophaps indica* (Linn.), were from time to time seen in the jungle or flying across a bit of open ground from one patch of forest to another. Another common denizen of the jungle and the trees round the old settlement site is the Indian Koel, *Eudynamis honorata* (Linn.), Green Parrots of more than one species frequented the tree tops, and on one occasion a pair of the Malay Bittern, *Gorsachius melanolophus* (Raffles), were seen in a small patch of jungle near the little artificial lake above the old settlement site on Camorta.

The bird that we were all anxious to see was, of course, the Megapod, *Megapodius nicobariensis*, Blyth, but in this locality it proved to be comparatively rare. A couple of Megapod mounds were found in the jungle only a few yards from the beach near one of the villages ; one of these mounds was undoubtedly fresh but the other was an old disused one. I caught a glimpse of one of these birds on the edge of a brackish swamp, thickly overgrown with *Nipa fruticans*, near Reed Point, but that was the only occasion on which I actually saw a specimen alive. Two examples were brought in, having been killed by the natives, and were in due course cooked and sampled ; but we came to the conclusion that Blanford* who states that " these birds are delicious eating" must have been prejudiced. The occurrence of the Megapod on these islands is one of the problems that zoologists have hitherto failed to solve, and they have therefore fallen back on the assumption that it has been imported by Malays ; but this assumption breaks down in the face of the occurrence of the bird in the Cocos Islands to the north of the Andamans. It is generally stated that the Megapod is absent from the Andamans, but I have seen in Little Andaman, in a patch of open jungle a hundred yards or so from the beach and the same distance from a mangrove creek, a large mound of earth and leaves about four feet high and ten feet in diameter, exactly similar to the mounds I saw in Nankauri, and I have no doubt that it was a Megapod mound though I did not see the bird itself.

So far as the number of species is concerned the avifauna of the Nicobars is comparatively poor. At the most only about hundred species have been recorded and of these several are mere winter visitors that are found throughout the whole of the Indian region. Various species that are so common on the coasts of Burma, such as the crows, the hornbills, jungle-fowl, pea-fowl, and smaller forms, like the Chesnut-Headed Bee-eater, are all conspicuous by their absence.

* Blanford, Fauna of British India, Vol. IV, p. 148.

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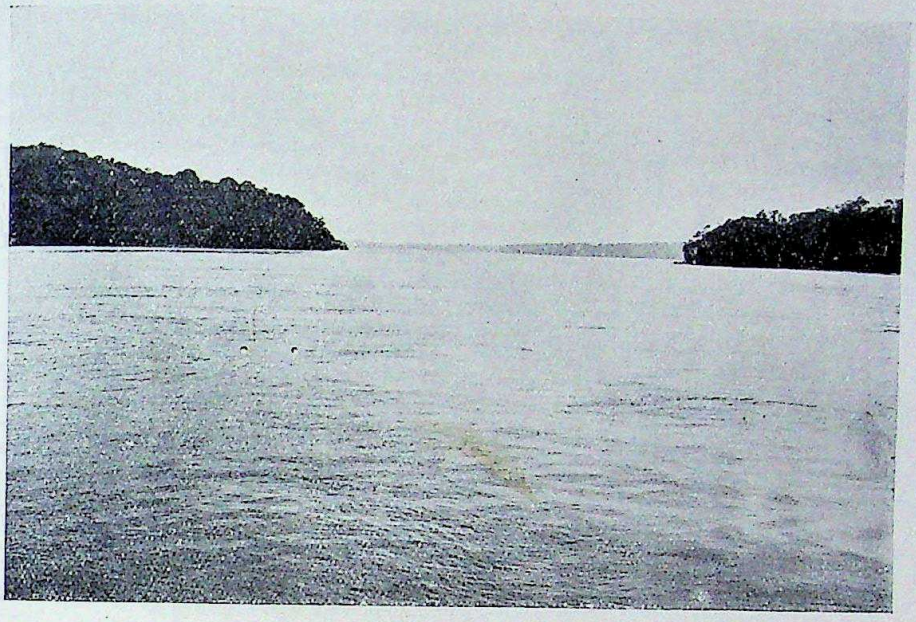

THE WESTERN ENTRANCE TO NANKAURI HARBOUR.

A MEGAPODE MOUND—NANKAURI ISLAND.

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I have already pointed out the complete absence of indigenous mammalia from these islands, but this is almost if not quite compensated for by the superabundance of reptiles. Though the actual number of species may be small in comparison with the continental fauna, the primæval forest is everywhere swarming with small lizards, most of which belong to the genus *Callotes*. So numerous are these little animals that there seems to be one to almost every tree and, as one quietly strolls through the more open parts of the jungle or along the paths cut by the natives, there is a continuous rustle on either side among the dead and rotting leaves covering the ground as these little animals make a dash for the nearest tree trunk and run up it like a flash, usually keeping to the reverse side till well out of reach. All the examples that I succeeded in obtaining seem to belong to the species *Callotes ophiomachus*. A species of Skink was also seen but I was unable to obtain a specimen. Frequenting the jungle or the more open patches of bush were several species of snakes, chief among which were examples of the Pit-vipers of the genus *Trimeresurus*. Boulenger* remarks "This genus includes terrestrial and arboreal species, but the two divisions are so insensibly blended as to render their distinction almost impossible." Even a single species may combine both arboreal and terrestrial habits and of the three specimens of *Trimeresurus gramineus*, which I saw, two were found on the ground, while the third was discovered by a lascar coiled round the extreme end of a branch of a tree and half hidden by the leaves about ten feet up. Natives are occasionally bitten by these snakes, but as a rule without a fatal result. One case, seen by me, had been bitten near the heel and the agent had already made free use of a Lauder-Brunton lancet: for inches round the whole skin was perforated with needle pricks, like an old pin cushion! Apart from considerable pain and local swelling, the man suffered no ill effects from either the bite or the treatment and in a few days was carrying on as usual. Anderson† reports finding two examples of *Trimeresurus cantori* (?) on Kachal, and one of these was captured alive and taken to Port Blair for experimental purposes. "In spite of his enormous fangs and poisonous aspect," this species, according to Anderson, "is unable to inflict fatal bites on a guinea pig." A python has been recorded from some of these islands. Boden Kloss makes no mention of its occurrence in his book but several of the older writers have recorded its presence; thus the Rev. P. Barbe‡ in his notes on the Nicobar Islands remarks "The Boa-constrictor is found also in the islands, particularly at Teressa," and Busch‡ also reports its occurrence on Kar Nicobar, where he saw one about 12 feet in length; according to Boulenger the species is *Python reticulatus*. No example was seen during our stay in Nankauri Harbour and it seems to be absent from Nankauri and Camorta Islands.

Before leaving the subject of the primæval forest I must not omit to mention that ubiquitous pest, the mosquito. The jungle simply swarms with *Stegomyia*; the vast majority belong to a single species characterised by the presence of a very distinct white spot on the dorsum of the thoracic region, a feature that is one of the characteristics of *S. assamense* which the Nicobarese specimens closely resemble. The moment one enters the jungle, and on calm days even when working on the beach some yards away, hundreds of these insects attack one and only the prolific use of some highly pungent ointment serves to discourage their attentions. Although the Nicobars possess the reputation of being an intensely malarious locality, neither officers nor crew suffered unduly from this disease, probably because we were living out in the harbour on board ship. At certain seasons many of the natives are affected and the carrier seems to be *Nyssomyzomyia ludlowi*.

* Boulenger, Fauna of British India "Reptilia and Batrachia," p. 425, 1901.

† Anderson, Census of India, Vol. III, Andamans and Nicobars, p. 164, Calcutta 1903.

‡ Selections from Records of the Government of India, Home Department, No. LXXVII, Calcutta, 1870.

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Other common insect inhabitants of the jungle are termites, butterflies, ants and cicadas. As regards the first of these one frequently sees large nests, constructed apparently by termites, of a dull grey or black colour and composed of a substance resembling *papier-mache*, either surrounding or projecting from a branch of a tree. Butterflies are fairly common both in the jungle and over the open grass land. I saw no very striking examples and for the most part the individuals seen were of a dull brown colour. Over the open lands these insects keep very largely to the tracks made by the cattle during their wanderings. As one follows such a track one invariably sees several brown butterflies flitting along in front of one near the ground. In this situation they have a high wall of grass on either side and it seems not improbable that this habit has been adopted as a protection against the high-winds of the monsoon. In places large spiders are to be found and as one walks through the jungle or between bushes in the more open tracts one frequently walks into a tough web in the centre of which is sitting a gaudy blue and yellow fellow who rapidly beats a retreat as one pauses to remove the tough clinging strands of her web that festoon one's face and topee.

As is only to be expected in islands situated within the tropical zone, wherever the coast line is protected coral abounds and forms great reefs extending out, in some cases for very considerable distances, from the shore.

The debris from these reefs gradually silts up on the shore side and gives rise to extensive mud flats, on which mangrove trees can find a hold and can flourish. All around the shores of Nankauri Harbour and Beresford Channel are extensive reefs spreading out from the land, and in the land-locked Expedition Harbour and Grand Harbour the growth of coral has extended so far out from the shore that a very great portion of their area is now occupied by reefs, while mangroves form an almost continuous fringe around their margins. As has been pointed out by Tipper.,* "The general effect of the mangrove swamps is to add gradually to the area of the island. The roots of the mangroves act as a sort of catch net for sediment washed on to them from the land and also for material brought by the tide", and he might also have added that they act as a basis for the growth of rock oysters, which further assist in the process of reclamation. As this process of reclamation extends further and further outwards, the inshore portion gradually dries and forms first a damp marine alluvium, on which only mangroves can flourish, and finally a dry marine alluvium on which cocoanut palms and screw pines find a suitable habitat. Throughout the whole length of the coast line of these islands this process is slowly going on, and patches of mangroves are spreading out upon the reefs, which in time will become connected into dry land. But in addition to this slow process of reclamation, in certain areas a further extension of these islands appears to have taken place within geologically recent times by the process of upheaval, for on both Camorta and Trinkat Islands I have seen masses of what seems to be undoubted reef coral now raised well above high water mark.

I was only able during our stay in Nankauri Harbour to pay a single visit to Trinkat. We sailed across Beresford Channel in the 'whaler' and landed at a large village, Ok-chauka, situated in a little bay on the west side of the island. The entrance to the bay is at low water almost completely blocked by an extensive coral reef. continuous with the main reef that runs along the whole of west coast. The landing place in front of the village lies between two stretches of mangrove swamp and consists of a small sandy beach, intersected here and there by exposed masses of reef-coral, now well above high water mark. The village itself stands back a little from the shore and is almost hidden in jungle, but from the sea-ward side its position was plainly marked by

* Tipper, "The geology of the Andaman Islands, with references to the Nicobars," Mem. Geol. Survey India XXXV, Pt. 4, p. 15. Calcutta. 1911.

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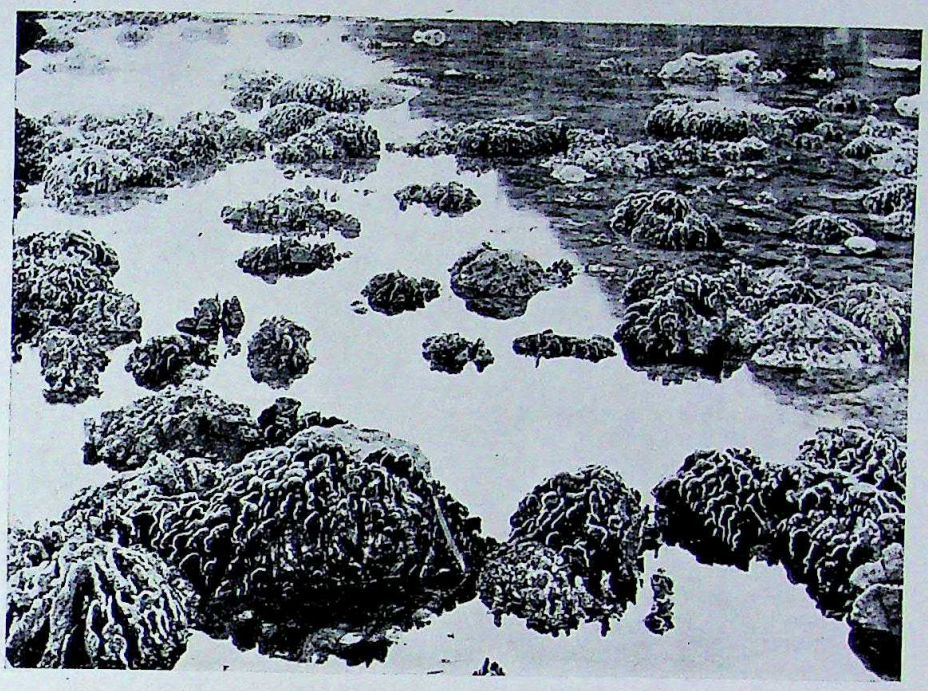

PART OF THE CORAL REEF OFF REED POINT, NANKAURI.

VIEW LOOKING ACROSS BARWELL SWAMP, CAMORTA.

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the usual tall bamboos with their ornamental tufts of grass. Around the village, which incidentally was much cleaner than those on the shores of Nankauri Harbour, were growing several Pumelow trees and a little way off was a large plantation of tall *Pandanus* trees. A short walk through the village and along a well kept path brought us out on the bank of a little '*Jheel*' where we had hoped to find some Whistling Teal, *Dendrocygna javanica* (Horsfield), but we were disappointed. In the jungle round were numerous pigeon, both Imperial Pigeon and Pied Imperial Pigeon being seen and shot. A little to the west of the village a tidal creek ran in from the mangrove swamp and here were numerous crabs and small fish. Several kingfishers were flying about and a specimen of the Glossy Calornis, *Calornis challybeus* Horsf., was added to our bag.

On the east side of Camorta, about a mile north of Naval Point, is a small bay, known as Barwell Swamp. Around the south and south-west sides of this bay, and shut off from it, except for one or two channels, by a strip of sandy foreshore, is an extensive mangrove swamp. Both this swamp and the bay itself dry almost completely at low tide. A somewhat similar, though much smaller, swamp exists on the east shore of Spiteful Bay a little to the south of Inuanga village. In both cases these swamps provided a habitat for thousands of specimens of all sizes of the mollusc *Potamides terebralia palustris* and in smaller numbers of a species of *Telescopium*. In places these are in such abundance that they literally form a mosaic pavement over the soft surface of the mud. In addition in these localities are numbers of *Sesarma* crabs and of the ubiquitous mudhopper, *Periophthalmus koelreuteri*.

Along the margins of these mangrove swamps, especially at low water a number of wading birds are to be found busily searching for food. Curlew, *Numeneus arquata*, are fairly common, but are remarkably shy and seldom allow one to get near to them. The Redshank, *Totanus calidris* (Linn.), the Greenshank, *T. glottis* (Linn.), and the Sanderling, *Calidris arenaria* (Linn.), were all seen and identified, and numerous 'snippet' were also present. Curlew and Whimbrel, *Numeneus phæops* (Linn.), were frequently seen on the mud flats exposed at low tide and the Eastern Reef Heron, *Lepterodius sacer* (Gmel.), in both its grey and white phases, was by no means uncommon. The Golden Plover, *Charadrius fulvus* (Gmel.) was common both in this locality and on the grassy slopes of the higher ground inland.

The central group of islands which enclose Nankauri and Expedition Harbours can boast of no rivers, such as those which are found in Great Nicobar. The only "river" that I know of in this group is theAlligator River that opens into Spiteful Bay on its eastern side, but the application of the term is liable to be misleading, for it is in reality only a tidal creek that runs for the greater part of its length—about three-quarters of a mile—through mangrove swamps, the roots of the mangroves being almost completely submerged at high tide. The creek finally terminates in a small swampy area overgrown with the stemless palm, *Nipa fruticans*, which only flourishes in areas where the water has a slightly brackish character. Hochstetter† describes a similar creek in the Great Nicobar in the following words:—

"The extreme end terminating on the sea is still in progress of formation, swampy and regularly flooded over by brackish water during high tide..... But in the interior the mangrove trees stand perfectly bare out of the mud, supported by numerous air roots variously spreading over the ground. The ground, flooded by brackish water is covered with a very large number of a species of Cerithium and inhabited by numerous crabs.....Farther up the valley the land rises and is only flooded by the river when its waters

† Hochstetter, Dr. F. von, "Contribution to the Geology and Physical Geography of the Nicobar Islands," Selections from Records of the Government of India, Home Department, No. LXXVII. Calcutta, 1870.

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are swollen during the rainy season. The vegetation becomes here at once more varied and is specially characterised by the stemless palm, *Nipa fruticans*." All the main streams of the islands appear to terminate in a similiar manner and although the term river is a euphemism when applied to Alligator River there seems to be little doubt that its cognomen is more or less justified. No alligator, *sensu stricto*, is known to occur nearer than China, but crocodiles almost certainly occur in this locality. Although I never saw one myself, the natives assured me that they were to be found here and that their dogs are afraid to enter the water, as on several occasions one has been taken by these animals. According to local information these crocodiles are small, measuring five to six feet in length. Boden Kloss ‡ records having seen one at the mouth of a jheel in Great Nicobar which measured about 10 feet in length and was brilliantly marked with yellow. One of the earliest references to the occurrence of these animals that I have seen is contained in a letter from the Rev. Gottfried Haensel, who was a missionary in these parts and who left the islands in 1787. To quote his own words,-" One of the most formidable animals with which these islands abound is the crocodile or alligator. Car Nicobar is overrun with them as are all the other Nicobar Islands, which have fresh water lakes and streams. They are of two kinds, the black kayman and the proper crocodile." The "black kayman" that he refers to is almost certainly the large lizard, *Varanus salvator*, that is comparatively common and attains to a great size, the largest that I have seen measuring seven feet four inches in length. The colour of this *Varanus* is black with yellow markings over the sides and back: they readily enter water when disturbed or pursued and I am inclined to suspect that it was one of these that Boden Kloss mistook for a crocodile. The frequency with which the crocodile is depicted on the painted 'scare devils' proves however that the natives are well acquainted with the animal and Blyth§ referred a specimen examined by him to the species *Crocodilus biporcatus* (= *C. porosus*.).

The coral reefs around these islands are all of the nature of fringing reef's and along the sheltered east coast of Camorta and Nankauri Islands these extend out for several hundred yards from the coast line proper. At their sea-ward edge these reefs arise almost vertically from a depth of 15-20 fathoms to within a few feet of the surface and even on a calm day with little or no wind blowing, the rise and fall of the swell causes such a rush of water over the edge of the reef that one realizes how easily in rough weather fragments of coral may be torn off and hurled shorewards over the reef to assist in the formation of the mud-flat beyond. When the sea is calm one can look down through the water and see numerous gaudy-coloured fish swimming backwards and forwards among the growing coral masses, while the surface of the reef-face is dotted over with large crinoids, of a black or greenish yellow colour, the delicate arms of which look like ferns growing out of crevices in a wall. Inside the growing edge of the reef the sea bottom consists of fragments of coral-debris on which scattered isolated colonies of living coral or masses of alcyonarians still maintain their existence. Still further inshore the bottom consists of soft mud or a mixture of mud and sand, which completely kills off all coral growth but forms a suitable soil for the growth of several different kinds of sea-weed. The quantity of sea-weed around these islands forms a marked contrast to the coral reefs and mud flats of the Burma coast, where weed of any kind is for the most part absent. Each of these weed patches has a fauna that is quite its own, distinguished by the various different schemes of protective colouration. Thus on red weed we find numerous red-coloured holothurians, while sheltering

‡ C. Boden Kloss, "In the Andamans and Nicobars," p. 69.
§ Blyth, E., "Notes on the Fauna of the Nicobar Islands". Selections from Records of the Government of India, Home Department, Vol. LXXVII, Calcutta, 1870.

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among the green weed we find green crabs and mottled green gobies. In places this sandy or mud flat is, instead of being smooth of surface, thrown into a number of little valleys and ridges: at the bottom of each valley a funnel-shaped depression leads down to a small central burrow and sheltering in the mouth of this is a small gobioid fish, that on the first sign of danger disappears down the hole. On the stretch of sand that is laid bare by each receding tide are hosts of small crabs, which live in burrows: some of these are round and spherical, *Dotilla*, while others have one claw enormously enlarged, *Gelasimus*. Sometimes a whole stretch of sandy beach may be twinkling with little brightly-coloured objects as these fiddler-crabs wander over the surface in search of food, each male waving its enormous gaudy-coloured claw: but the first step forward or even a sudden movement of the arm will cause the total disappearance of these little animals down their holes.

A single example of the eel, *Ophichthys colubrinus*, was found lying buried in the sand, with only the anterior two or three inches protruding, on the beach near the entrance to Expedition Harbour. Its black and white rings render it very conspicuous and may be an example of warning colouration, for it has been credited with possessing poisonous properties.* Other inhabitants of these stretches of sand and mud are starfish, of which a few were obtained near Naval Point, and holothurians though these latter are far more common in rock pools and on the reefs themselves. Crawling over the mud-flats at low tide are numbers of molluscs, *Nassa* and *Natica* being the genera more commonly represented, and numerous examples of the stalk-eyed crabs of the genus *Ocypoda* can be found busily hunting for food. In certain areas *Gelasimus* crabs are also common but for some unexplained reason their distribution seems to be discontinuous, large areas of sand showing no trace of either them or their burrows. **

An interesting feature of the reefs is the peculiarly local distribution of the various kinds of coral. Everywhere the main bulk of the wall of coral on the face of the reef consists of Porites but inside this in any one area some one particular kind of coral seems to thrive to the almost complete exclusion of all other forms. Commencing off Naval Point at the eastern entrance to Nankauri Harbour and extending northward along the east coast of Camorta the bulk of the reef consists almost entirely of stag-horn coral (*Madrepora*), scattered about among the branches of which are numbers of round or oval mushroom corals (*Fungia*) and in patches a few colonies of the branching forms of *Millepora* and *Pocillopora*. The prevailing tint of the growing coral is brown or red and the tips of the branches vary in colour but are usually pale blue or mauve. Living among the branches of the coral and firmly attached to them are numerous small flattened oysters and crawling over the branches are crabs and alpheids many of which show very distinct protective colouration. If a mass of this stag-horn coral be lifted out of the water and shaken over a net a number of small fish, belonging for the most part to two species, will be secured. These are the little greenish-yellow *Heliastes lepidurus* and the black and white banded *Tetradrachmum aruanum*.

On the opposite side of the entrance to Nankauri Harbour off Reed Point the bulk of the coral growing on the reef consists of rounded masses of *Montipora* in which the plates are arranged vertically and radiate from the centre of the mass. The basic colour to these colonies also is brown but the margin of each plate is pure white. Here we found, embedded in and almost completely enclosed by coral debris, a number of *Tridacna*, whose brilliantly coloured mantle renders

* Wood, Jones., "Coral and Atolls," p. 329, London, 1912.

** In many places trees that were growing on the edge of the jungle have fallen down and their dead and decaying trunks and branches now lie prone on the sandy shore at or a little below high-water mark and these serve as a habitat for numbers of molluscs belonging to two species of *Littorina*.

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them one of the most conspicuous objects of the reef. Large Actinians, *Discosoma*, of a brown colour, were growing in the shallow pools attached to dead masses of coral, and scattered about were masses of a compound actinian of a grey-white colour. Each of these serves as a shelter for other animals. The brown sea-anenome harbours among its tentacles a little brown fish, *Amphiprion acallopisius*, while the white form serves as a habitat for small crabs and alpheids. Living in holes among the coral debris were a number of sea-urchins with long delicate spines, and numerous little gaudy-coloured fish were swimming about in the coral pools. Crabs were far more common here than among the stag-horn corals and one or two large starfish were obtained near the edge of the reef.

Again in Octavia Bay on the north side there is a patch of reef that consists for the most part of rounded masses of *Porites* overgrown with dense masses of a pale leathery alcyonarian. Anderson † calls attention to a similar area on the south side of Nankauri Harbour where the reef was characterised by the presence of digitate *Alcyonaceæ* of at least two species. In these colonies the stocks are 1-2 feet in diameter and the figures 1 foot in length.

In a small bay on the western side of Camorta, just north of the entrance to Expedition Harbour, there is a small patch of coral consisting entirely of a colony of *Turbinaria*, of a yellow colour and with flattened plate-like outgrowths set more or less parallel to the sea-bottom. It was here that one afternoon I obtained a fine specimen of the poisonous fish *Synancaea verrucosa*. I was examining a small rock and coral pool in the centre of which was a yellowish mass which I at first took to be a lump of coral overgrown with patches of algæ. After a minute or two it began to dawn on me that the motionless object was a large fish—and so it proved to be!

I do not propose to go into details regarding the causes of these local variations in the type of coral met with on the reefs, and I would refer anyone who is interested in the subject to Wood-Jones,‡ work on the Coral reefs of the Cocos-Keeling Islands.

I have already referred to the comparative paucity of bird life in these islands but one would expect to find that islands such as these, situated well out in the ocean, would have a considerable population of sea-birds such as gulls and terns. One species of tern, *Sterna melanauchen*, is said to breed in the Andamans and Nicobars, but during the whole of our stay in the vicinity I never saw a single example; and on only a single occasion did I see any gulls. We were steaming down the west coast of Carmorta and near the north end of the island in the distance were three gulls and those were all that I saw during five months. Every day one could see at some part or another of Nankauri Harbour examples of the fine white-bellied sea-eagle, *Haliætus leucogaster*, soaring over the foreshore and occasionally swooping down on to some object below. One pair were always present over the beach near Naval Point though I never could discover where they were nesting. Curlew, whimbrel and reef herons were always to be seen, though never in large numbers, searching for food on the reef at low water but true sea-birds were invariably absent.

In a paper as short and of necessity as discursive as the above one cannot hope to do even the merest justice to a locality as interesting as the Nicobar Islands, nor have I attempted to touch upon the many interesting problems in evolution and distribution that confront a zoologist who essays to deal with the fauna. Separated as these islands have been through long ages from the rest of the Burma-Malayan Peninsula and from one another it is only to be expected that new species have arisen. In recent years a number of these have been recognised and describ-

† Anderson., Census of India, 1901, "The Andamans and Nicobars," Vol.III, p. 164, Calcutta, 1903.

‡ F. Wood-Jones, "Coral and Atolls," London, 1912.

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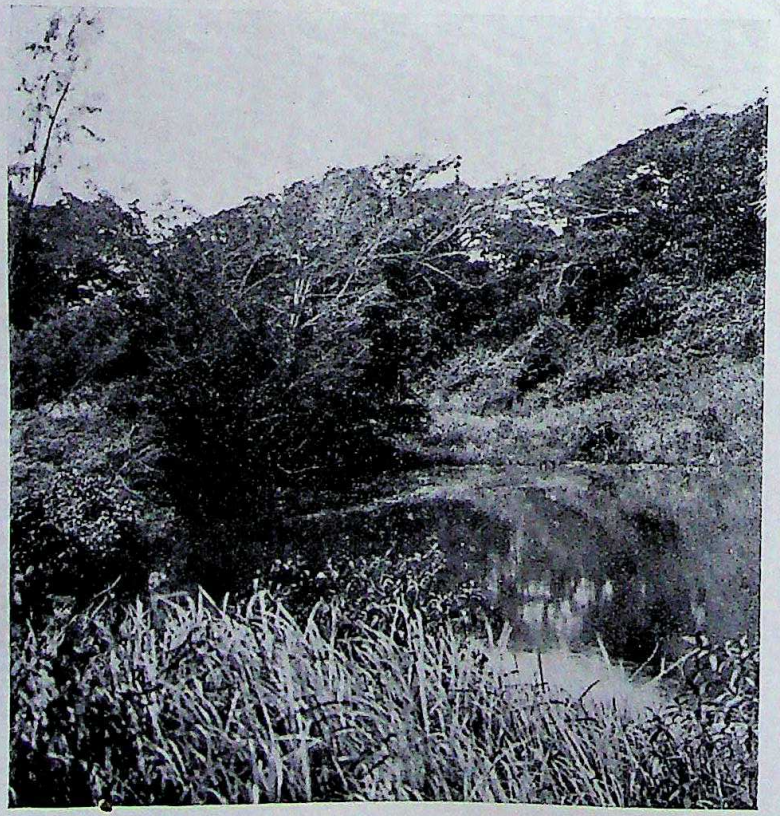
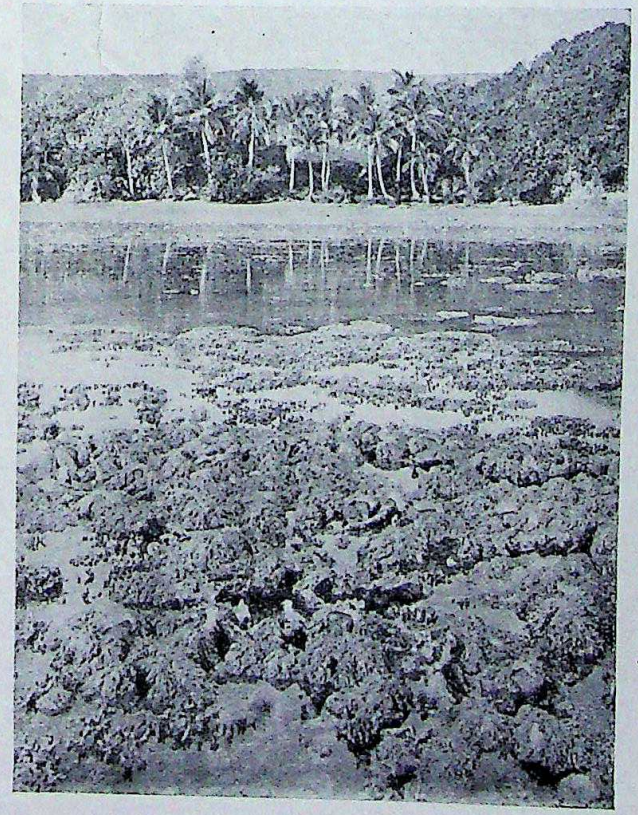


THE ARTIFICIAL LAKE, CAMORTA.



A BED OF ALCYONARIANS IN OCTAVIA BAY, CAMORTA.

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ed, and in many cases these seem to be confined to individual islands, thus rendering the problem still more complex and its solution still more difficult. Much work must yet be done before we shall be in a position to review the fauna as a whole and to trace its origin in the past.

It is beyond my powers adequately to express the many beauties of these islands. The Imperial Gazetteer, which one would hesitate to accuse of bias or sentiment, claims for this region the distinction of being one of the beauty-spots of the world, and as regards the truth or otherwise of this assertion I feel that I can safely leave my readers to draw their own conclusion from the photographs I have given above.

Finally I should like to end with a tribute to my shipmates, whose ready help and unfailing good fellowship rendered my visit to these islands one of which I shall always have a very pleasant memory.

[The Editors regret that owing to financial considerations they are unable to publish all the interesting photos taken by Major Seymour Sewell and which fully endorse the claim made by the writer in the Imperial Gazetteer.]

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A CONTRIBUTION TO THE ORNITHOLOGY OF CASHMERE.

By

Hugh Whistler, F.Z.S., Indian Police.

In spite of the number of ornithologists and sportsmen who have visited Cashmere, and of the number of specimens illustrative of the ornithology of Cashmere which are to be found in various museums and collections, no complete account of the avifauna of the country has been published. There is indeed comparatively little on record at all in print regarding this most interesting of countries to the naturalist. Under these circumstances it appears to me worth while to record some notes made in Srinagar during a short stay of about six weeks, in the hope that they may be of value to anyone who later on has time and the opportunity to fill up this conspicuous gap in our knowledge of Asiatic ornithology.

My trip was undertaken at the shortest notice and without any previous intention, being solely due to the opportunity afforded by the late difficulty in securing steam ship accommodation owing to which an interval had to elapse between the commencement of a period of leave and my departure for England.

I left Rawalpindi by motor on the 1st April (1920) and arrived at Kohala, the first point in the territory of Cashmere State, on the afternoon of the same day; that night was spent at Garhi, the journey being resumed early next morning, so that I reached Srinagar about 4 p.m. on the 2nd April. I remained at Srinagar until May 12th: when I started down again by motor and reached Kohala about 8 p.m. that night. A few observations were made during the course of these journeys along the motor road and they have been included in the following notes; otherwise all records refer to the immediate neighbourhood of Srinagar.

The distance between Rawalpindi and Srinagar by road is nearly 200 miles. From the moment of entering Cashmere territory at Kohala the road follows the course of the Jhelum river, running alongside of it at varying heights through a vast belt of mountains as far as Baramullah, where the road leaves the mountain barrier most abruptly and emerges into the Happy Valley. Here the character of the country changes with almost equal suddenness. The mountain scenery, familiar to all travellers in the Outer Himalayas, gives place to a wide plain whose salient features are reminiscent of the plains of Northern France and Holland or of the flat cultivation of Suffolk and Essex. For mile upon mile the road passes through long lines of poplars, closely planted and growing to a great height. All about the river and the numerous tributary channels and dykes grow willows, singly and in plantations; clumps of mulberry trees are on all sides and here and there stand the giant chenar trees, most wonderful of all.

Srinagar itself is situated at an altitude of about 5,000 feet above sea level, and is built on the River Jhelum. The native city is down stream and covers a wide area on both banks of the river, connected by seven bridges, of which the lowest had been washed away some months before my visit. Above the native city stands the European quarter and the shops which cater for visitors. Here good houses and pleasant gardens are diversified by wide expanses of turf with fine trees, in marked contrast to the crowded and filthy city.

North of the European quarter stands the Takht-i-Suleman, a bare rocky hill surmounted by an ancient temple, and rising to a height of over 6,200 feet. Behind the Takht lies a range of mountains that reach a still greater height and form part of the mountain ring which entirely surrounds the Happy Valley. At the foot of the Takht and the mountains behind it spreads the famous Dhal lake; while the area between the city and the lake is an intricate maze of gardens, orchards, and waterways. All visitors to Srinagar are expected to climb the Takht. From it a wonderful view is obtained and the climber is able to appreciate to the full the circumstances of the vale of Cashmere; it lies before

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him as a wide plain surrounded by a complete circle of snows, and traversed by the tortuous course of the Jhelum river. The Dhal lake at his feet, the Woolar lake in the distance, and the numerous smaller lakes and patches of flood or irrigation water, all tend to give the impression that the plain is waterlogged,—almost a gigantic marsh.

In comparison with the plains of India or the various hill stations, Srinagar has an atmosphere predominantly English ; the clean fresh air, the gardens and orchards, and the green level turf all contribute to this impression, which is heightened by the Avifauna. The majority of the common birds are of types familiar to the Englishman. The loud "Jack" of the Daws and the song of Tickell's Ouzel, the call of the Wryneck and the twitter of Goldfinches, all recall familiar sounds of the English countryside. Swallows, Kingfishers, and Sparrows are abundant. Flocks of Starlings feed busily on the lawns. And if the abundance of Kites, Hoopoes, Bee-eaters, and Golden Orioles introduces an element that is not English, it is after all as much South European as Asiatic.

The spring of 1920 was an unusually late and cold one. In fact the residents of the place told me everything might be considered at least three weeks later than usual. To this fact may be attributed the small number of nests found. The majority of the common birds were just beginning to lay eggs at the date of my departure.

Finally I should like to acknowledge with gratitude the great assistance rendered to me by Miss G. Robinson in the study of the birds of Cashmere. I have also to thank Dr. Hartert and Dr. C. B. Ticehurst for their assistance in identifying many of the skins collected.

The Jungle Crow—*Corvus coronoides intermedius*, Adams.

While the Jungle Crow was abundant all along the country from Kohala to Baramullah, it proved to be comparatively scarce in the plain of Srinagar which is not sufficiently wooded for its requirements. Only a few individuals were seen actually in Srinagar.

The House Crow—*Corvus splendens*, Vieill.

Observed in small numbers in Srinagar and about the road, but by no means as common as the next species or as in the plains of the Punjab.

The Jackdaw—*Colœus monedula collaris* (Drummond).

On the upward journey of April 1st a small party of Jackdaws was first observed at Domel, 21 miles from Kohala, and some more were seen next day about the 68th mile. After that the species became very numerous and one of the most familiar of the objects along the roadside. On the return journey of May 12th the Jackdaw was common all along the road as far as Baramullah but was not observed below Uri.

In Srinagar it was the most common and noticeable of all the birds and with the well known call greatly contributed to the English atmosphere of the place ; it breeds in the hollow Chenar trees, in the roofs of the houses and in holes of walls and bridges, being just as impudent and tame, as is *Corvus splendens* in the plains.

On my first arrival I was much struck by the stream of Jackdaws which poured into Srinagar in the evenings and left again about sunrise. These flights continued throughout my stay but appeared to diminish in number, being latterly perhaps composed of non-breeding birds ; as far as I could ascertain these flights roosted in the beds of willow trees which border all the waterways between the city and Dhal lake.

Nidification was in full swing by about the middle of April and from that time onward the birds were to be seen in the day time mostly in pairs sitting about side by side in the vicinity of their nests ; so that a huge Chenar tree, hollow with age, would be seen to hold a dozen or more birds, sitting sedately pair by pair, each near the hole that held its nest.

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The first eggs, two incomplete clutches of 3 and 2 respectively, were obtained on May 8th, but when I examined a large number of nests in a colony about some buildings on May 10th most of them were either unfinished or empty, although two nests contained clutches of 5 eggs, all fresh. There was of course a good deal of variation according to site in the size of the nests, many of them being in holes under the rafters and eaves which previously I should have considered too small for them to use. The nests were built of the usual miscellaneous materials, sticks and thorny twigs with a lining of dirty wool, rags, and hair; indeed I found this particular colony by following up the individual pairs which were tearing the wool off a half decomposed sheepskin hung up in the fork of a tree.

The Yellow-billed Blue Magpie—*Urocissa flavirostris* (Blyth).

On April 2nd two or three individuals were seen in the hills between Naurshehrah (mile 87) and Baramullah.

The Black-throated Jay—*Laletris lanceolatus*, (Vig.).

On 12th May a pair were seen on the road a short distance below Baramullah.

The Cashmere Great Tit—*Parus major cashmirensis* (Hartert).

This race of the Great Tit was abundant on the Srinagar plain and at my first arrival was still commonly met with in parties, although the breeding song was already to be heard.

On April 28th a bird was seen carrying nesting material into a hole in the trunk of a mulberry tree and seven fresh eggs were taken from this nest when it was opened up on May 11th. The female was caught on the eggs and contained an eighth egg in the oviduct. The nest hole was interiorly large and contained three or four handfuls of roots, dry grass, bents, and a few rags, with a thick lining of hair and wool. On the same day a single egg was found in another nest hole, containing but little material, in a hole in the trunk of a fruit tree.

A series collected yield the following measurements:—

	Bill from skull.	*Wing.*	*Tail.*	*Tarsus.*
4 Males ..	12·5—13	73·5—76	60·5—65·5	19—21 mm.
8 Females..	12 —13	68·5—72·5	56·5—61	18·5—20 mm.

The clutch of seven eggs measure 18—18·5 mm. in length and 14—14·5 mm. in width.

The Crested Colé Tit—*Parus melanolophus* Vig.

A flock was seen on the Bund on April 7th and 11th and by the Dhal lake on April 14th; a single bird was seen by the temple of the Takht-i-Suliman on April 17th and a pair in the small pine wood below it on April 19th.

The Fire-cap—*Cephalopyrus flammiceps* (Burton).

This species was observed on several dates between April 19th and May 9th. On every occasion, with the exception of the finding of a solitary male in the bushes about a small mountain stream on April 29th, the birds were in flocks which were feeding in willow trees, working the blossoms, catkins, or old seed cases after the manner of Redpolls and indulging in the same variety of acrobatic postures. They were not at all shy, and appeared in the willows even of the most frequented localities such as the Bund.

The Western Streaked Laughing Thrush—*Trochalopteron lineatum* (Vig.).

This Laughing Thrush is of course common on the hillsides of Cashmere but it was interesting to note, in view of Whitehead's remarks on its partial migration in winter to the orchards of Kohat (*Ibis*. 1909), that while it was seen occasionally on my first arrival in the gardens of Srinagar and about the edges of the Dhal lake, it appeared to have disappeared about the middle of April and had doubtless returned to the hillsides. No specimens were obtained so it is impossible to be certain of the sub-species to which the birds should be attributed.

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The White-eye—*Zosterops palpebrosa* (Temm.).

A flock of White-eyes were seen in a willow grove by the Dhal lake on April 25th but the species was otherwise not observed in Srinagar. On the road up I only noticed a single flock at Gahri on April 2nd, although on the return journey of May 12th the species appeared common all along the lower part of the road below Baramullah.

The White-cheeked Bulbul—*Pycnonotus leucogenys* (Gray).

The White-cheeked Bulbul was abundant throughout the road from Kohala to Srinagar and in Srinagar it is one of the most characteristic and noticeable of the birds. With its bright cheeky behaviour, quaintly cocked crest, and pleasant notes, it is a universal favourite, catching the eye even of the most unobservant, as it enters boats and houses, or hops about the feet of picnic parties in search of stray scraps and greedily eating the pieces of bread and cake thrown to it. The first nest, with three fresh eggs was found on May 10th; it was a large but shallow cup, loosely constructed with a foundation of dry grasses and fibres, followed by a layer of the same materials mixed with fine strips of bark; the lining was a thick layer of fine roots. It was placed some 10 to 15 feet from the ground on the thick stem of a large vine growing against a roadside poplar.

The Red vented Bulbul—*Pycnonotus hæmorrhous* (subs. ?).

One was seen at Garhi on April 1st.

The Himalayan Black Bulbul—*Hypsipetes psaroides*, Vig.

Observed fairly commonly, firstly in small parties, and after the beginning of May in pairs, both in Srinagar and about the greater portion of the road.

The Wall Creeper—*Tichodroma muraria* (L.)

On April 17th a Wall Creeper was seen climbing about the huge stones of the temple on the summit of the Takht-i-Suliman (6263 feet).

The Himalayan Tree Creeper—*Certhia himalayana*, Vig.

A single Tree Creeper was seen with a large hunting party of *Phylloscopi* in the pine wood on the Takht-i-Suliman on April 19th.

The Himalayan Wren *Troglodytes troglodytes neglectus* Brooks.

One was seen in the ruined monastery of Pari Mahal on April 15th.

The Indian Ashy Drongo—*Dicrurus leucophoeus longicaudatus* (Hay.)

The Black Drongo—*Dicrurus ater* (Herm.).

No Drongo was seen on the journey up or in Srinagar until April 11th when a pair were seen at Gupkar: one or two others were seen in May. These were probably all *D. longicaudatus*. On the return journey however Drongos were common all along the road both in the Happy Valley and throughout the hilly portion of the road. Although these two species are not in my opinion easy to discriminate in the field, especially when seen from a motor, I think that the birds seen above Baramullah were all *Dicrurus longicaudatus*, but that below Baramullah they were largely replaced by *D. ater*.

The Great Reed-warbler—*Acrocephalus stentorea brunnescens* (Jerd.).

On my first visit to the Dhal lake on April 8th the young growth of the reed beds was just commencing to appear above the surface of the water and the only Reed-warbler seen was a single bird creeping about a line of osiers. I first heard the song on April 21st, by which date the reeds were halfgrown and the species had apparently become common and after that the birds were to be heard or seen in every patch of suitable cover on the lake. The song is not easily described; it is very loud and variable, harsh and metallic in tone for the most part, but interspersed with pleasant bars. Like all the members of the genus the Great Reed-warbler is a skulker and appears to prefer to move about the reeds close to the surface of the water, but it is certainly not shy and allows a close

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approach and on occasion sings from the summit of some exposed pole or branch. Owing to the lateness of the season it did not appear worth while searching for nests before my departure.

The Brown Bush-warbler—*Horeites pallidus*, Brooks.

A male was shot near Garhi on April 2nd as it was creeping about in some bushes by the roadside.

The Indian Lesser White-throat *Sylvia curruca affinis*, Blyth.

Not observed before April 11th: but from that date onwards until my departure on May 12 small numbers seemed to be passing through Srinagar to the breeding quarters. At the same time however, at least as early as April 20th the lower slopes of the range of hills just behind Srinagar were tenanted by birds which from their behaviour, singing courting and quarrelling, appeared to have reached their breeding quarters and were preparing to nest. Many old nests seen in bushes on these hill sides were probably of this species.

Although I have assigned these birds to *Sylvia curruca affinis* it is with some hesitation. It is well known that some race of Lesser White-throat breeds in Cashmere in considerable numbers, and in the literature of the subject they are always called *Sylvia affinis* but the breeding range of this race as given in the Vogel Pal: Fauna does not include Cashmere, and the only specimen that I obtained, which was killed by accident, proved on comparison to be an example of Hume's White-throat, *Sylvia althoea*. It was unfortunate that no series was obtained, but at the time I was under the impression that there was no doubt regarding the identity of the Cashmere breeding race, and I was unwilling to devote any of the short time at my disposal to collecting so common a bird.

The Least White-throat—*Sylvia curruca minula*, Hume.

A White-throat seen but unfortunately not procured on a stony hillside, about 6,000 feet, on April 27th was attributed to this race: it was doubtless on passage.

Hume's White-throat—*Sylvia althœa*, Hume.

As mentioned above, a male was obtained on 24th April on the hillside above Pendreathan about 6,000 feet.

The Siberian Chiff Chaff—*Phylloscopus collybita tristis*, Blyth.

The Siberian Chiff Chaff was passing through Srinagar throughout the whole of the six weeks that I was there. The greatest rush appeared to occur roughly during the 10 days from the 13th to the 22nd of April, but the species was sufficiently common on most days. It was very partial to the lines of osiers in the Dhal lake, in addition to being found in the ordinary haunts of the other Willow-wrens.

The Yellow browed Willow-wren—*Phylloscopus inornatus humei* (Brooks).

This species, like the last, was passing through Srinagar during the whole of my stay, and the two together must have included the vast majority of the migrating Willow-wrens which was one of the marked features of the Avifauna. The period of their greatest abundance was perhaps a few days later than in the case of *P. c. tristis*.

The Olivaceous Willow-wren—*Phylloscopus griseolus* (Blyth.)

This Willow-wren passed through Srinagar on its spring migration in small numbers and was noted by me on various dates from April 19th until May 10th. Unlike the vast majority of the migrating Phylloscopi, which congregated in the willow groves that are so widespread a feature of Srinagar, this bird was chiefly found singly or in small parties in open ground on hillsides amongst the scrub and low bushes of the boulder-strewn slopes.

The Large Crowned Willow-wren—*Phylloscopus occipitalis occipitalis* (Blyth.)

This species was not noticed until April 26th but from that date onwards until my departure, it was met with in small numbers amongst the rush of migrating willow-wrens.

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The Greenish Willow-wren—*Phylloscopus nitidus viridanus,* Blyth.

This Willow wren was common on passage during the second week of May when two specimens were preserved. It was also I believe present a week or two earlier.

The Himalayan Starling—*Sturnus vulgaris humii,* Brooks.

On the upward journey of April 2nd Hume's Starling was first observed at the 108th mile and became gradually commoner along the road side as we drew nearer to Srinagar. In Srinagar itself the bird was most abundant and was still in large flocks, although the yellow bill of the breeding plumage had been assumed and the males were in song and some individuals were already at their nesting holes. I did not however secure any eggs before my departure. No Starlings were seen below Srinagar on the return journey.

The song is of the usual Starling character but not so loud as that of the typical race: whilst it is uttered the wings are frequently flirted in the manner of the latter. I could detect no special characteristic in the habits of this race in Srinagar: the main stronghold of the birds was in the extensive groves of pollarded willows in the holes of which they were obviously intending to breed, but pairs were tenanting Chenar and other trees in the vicinity of the houses, although I did not actually observe any attempt at occupying any holes under eaves or in walls.

A series of 6 males and 4 females was collected. Their measurements are as follows in millimetres:—

	Bill f. skull.	*Bill f. nostril.*	*Breadth at nostril.*	*Wing.*	*Tail.*	*Tarsus.*
Males	29—31·5	17—19·5	7—7·5	116—121	56—59	29·5—31·5
Females	27·5—29·5	17—18·5	7—7·5	112·5—119	54—57·5	29·5—31

The adult female differs from the adult male in having the body feathers shorter and broader so that on the mantle, scapulars, back and upper tail coverts the buff tips are less completely worn away and those parts remain more spotted. The metallic gloss in less brilliant, and less extensive on the secondaries and greater coverts. The first summer birds, the males amongst which were certainly about to breed from the size of the testes, differ from the adults in the markedly less brilliant gloss, and the presence of the buff spots of the winter plumage, but partly worn away, which remain throughout the plumage, and on the abdomen and under tail coverts still largely conceal the black. In the first winter plumage of this race the spots are so large that the abdomen appears almost white, (see *Ibis.* 1909, 57).

In this race the colour of the soft parts appears somewhat variable. In the adult male the iris is dark brown; mouth livid fleshy, bill bright yellow, horny steel colour at base of lower mandible, nostril area horn colour; feet salmon brown, tarsus darker, claws dusky horn darker toward tip. The immature males show roughly the same colours.

In the adult female the iris is pale yellow and the bill horny yellow, anterior half tinged with orange. The remainder is as in the male; the immature females have the bill either horny mottled with brown and yellow, or bright yellow, with the base of the lower mandible horny.

The range and migrations of the Himalayan Starling appear to be very imperfectly known. Hartert (Vog. Pal. Fauna, I, 45) states that it breeds in the Himalayas from Cashmere to Nepal and in the N. W. Punjab, wintering in the plains of N. W. India. That it breeds in Cashmere has long been well known, and it undoubtedly breeds in the valley of Peshawar (cf. N. E. 2nd ed. I. 369). But I cannot trace the authority for the further extension of its breeding range eastward. It certainly does not breed in the Kangra Valley, Kulu, Lahul, Spiti, the Simla hills, or British Gahrwal. Although I have paid particular attention to the masses of Starlings which visit the Punjab in winter I have only met with this race in small numbers in the Kangra valley and in the district of Jhelum: here a

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small marked passage passed through from the middle of September until the middle of October, and apparently returned about the middle of February: they became abundant by the end of that month, decreased by the end of March, and only a few remained as late as April.

Common Mynah.—*Acridotheres tristis* (L).

Observed commonly throughout my stay in Srinagar and all along the road on both journeys.

The Golden Oriole.—*Oriolus oriolus kundoo*, Sykes.

The Golden Oriole is only a summer visitor to Srinagar and was not observed until April 20th after which it quickly became abundant. Several of last year's nests were noted in the trees about the European quarter.

The Rufous-backed shrike.—*Lanius schach erythronotus* (Vig.).

The Rufous backed shrike is certainly one of the commonest and most characteristic birds of Srinagar; it is found everywhere, in the fields and orchards, in gardens and villages, and particularly in the poplars that thickly border all the roads, while individuals visit the reeds-beds of the Dhal lake. It occurs of course in the Murree hills and I presume also in all the hills between Kohala and Baramullah, but their numbers there do not strike one in the same way as after Baramullah is left and the poplars start with a Shrike to every couple of hundred yards or so. On my first arrival the birds did not appear to be paired but courting commenced with the first fine weather and nidification was in full swing by the end of April though I did not actually obtain any eggs before my departure. Like many of the genus this Shrike is a great mimic and songster.

The Short-billed Minivet—*Pericrocotus brevirostris* (Vig.).

Observed in small numbers, at first in parties and latterly singly or in pairs, throughout my stay in Srinagar.

The Cashmere Red-breasted Flycatcher—*Muscicapa parva hyperythra* (Cab.).

This Flycatcher was first observed on April 14th on which date two specimens were obtained in a willow grove by the Dhal lake. For the rest of the month it was observed in small numbers about gardens and orchards, although only males were seen. After May 1st no individual was seen until May 10th on which date a female was shot and a second seen. One or two individuals were seen from the motor during the first stages of the journey down on May 12th. The behaviour and habits are similar to those of *M. parva parva* in the plains, but the upward jerk of the tail is more noticeable owing to the greater length of the feathers. The call note is indistinguishable from that of *M. superciliaris*.

Seven males preserved yield the following measurements:—bill from skull 12·5–13·5; wing 65·5—69·5; tail 49—54; tarsus 17·5—19. The only female obtained measures:—bill from skull 13·5 mm.; wing 67·5; tail 50·5; tarsus 18·5. All the above had the organs slightly developed and were somewhat fat. The colour of the soft parts was as follows:—iris dark brown; mouth yellow; bill yellow, upper mandible brown (males), dark brown, basal half of lower mandible yellowish (female); legs sooty brown, soles dull olive (males), black (female).

The White-eyebrowed Blue Flycatcher—*Muscicapa, superciliaris* Jerd.

First observed on April 17th when a male was feeding about the rocks of the summit of the Takht-i-Suliman. After this it became fairly common and remained so until my departure on May 12th, being often found in company with the last species. It was I presume on migration.

The Rufous-tailed Flycatcher—*Alseonax ruficaudus* (Swains).

A single individual was seen in an orchard on May 1st.

The Slaty-blue Flycatcher—*Muscicapa tricolor* (Hodgs.).

A female was shot in a grove of fruit trees on May 10th where it was hawking about the boughs in company with *M. superciliaris* and *M. hyperythra*.

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The Rufous-bellied Niltava—*Niltava sundara*, Hodgs.

I am practically certain that I saw a male of this species on the embankment of the Chenar Bagh on April 12th.

The Paradise Flycatcher—*Tchitrea paradisi paradisi* (L.).

With the exception of an adult male seen on April 6th no Paradise Flycatcher was seen until April 14th. After that date the species was common about Srinagar until my departure and I saw several about the road on my downward journey.

The White-capped Redstart—*Chaimarrornis leucocephala* (Vig.).

One or two were seen along the Jhelum river on April 1st between Kohala and Domel.

The Plumbeous Redstart—*Chaimarrornis fuliginosa fuliginosa* (Vig.).

Observed fairly commonly on April 1st about the banks of the Jhelum river from mile 25 onwards to about Uri. On the return journey of 12th May one was seen near Uri.

The Indian Black Redstart—*Phoenicurus ochruros phoenicuroides* (Moore).

A few individual Redstarts were seen as follows, in every case at the foot of the Takht-i-Suliman, or of the hill behind it:–April 17th one male; April 27th a male and female; April 28th one male; May 10th two females.

The Blue-headed Redstart—*Phoenicurus coeruleocephala* (Vig.).

A few were observed both on April 20th and 29th in a nullah at about 7,500-8,000 feet elevation on the hill behind the Gupkar corner.

The Blue Rock Thrush—*Monticola solitarius pandoo* (Sykes).

First observed on April 20th but it had perhaps been overlooked as by the end of the month pairs were fairly common on the bare hillsides in that area between about 5,500 feet and 8,000 feet, which for the most part was so wanting in bird life.

The House Sparrow—*Passer domesticus parkini*, Whistler.

On arrival in Srinagar I was immediately struck by the marked difference of the House Sparrows from the common *Passer d. indicus* of the Plains. I was therefore careful to collect a small series which were compared in England with the series of sparrows in the Tring Museum and in Dr. Ticehurst's and my own collections; this confirmed my opinion andthe birds were described (Bull. B. O. C.,xli,13,1920) as *Passer domesticus parkini*, with the type locality Srinagar. It is distinguished from *indicus* by the richer chestnut of the mantle, scapulars, and lesser wing coverts, and by the considerably larger size and heavier bill; bill from skull 14–15; wing 77·5–83 (majority over 80); tail 57–62·5; tarsus 18·5–20 mm. The female differs from the female of *indicus* only in the larger size and heavier bill: wing 75–78·5; tail 53–61 mm. The range of this new race has not yet been fully worked out; but it occurs at Bampur, Karman, Shiraz, Bushire (in winter), Afghanistan, and probably Baluchistan. It is I think the breeding bird of Lahul and Spiti. It is a migratory species and in winter visits the plains of Sindh and the Punjab, and possibly further south and east.

The Common Rose-finch—*Carpodacus erythrinus roseatus* (Hodgs.).

A few parties, on migration, were met with from April 28th up till the date of my departure.

The Himalayan Gold-finch—*Carduelis caniceps caniceps*, Vig.

The Himalayan Gold-finch was very common throughout my stay in Srinagar, occurring in flocks which had not fully broken up even as late as May 12th. These flocks were found largely about the lower slopes of the hills, feeding on the ground amongst the boulders, or visting the orchard and groves in the neighbourhood. The huge Chenar trees were also much frequented by the birds which doubtless feed in the seeds remaining in the "ball".

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Four males and two females preserved yield the following measurements in millimetres :—

	Bill from skull.	*Wing.*	*Tail.*	*Tarsus.*
Males ..	16·5—17	79·5—81	49·5—51·5	14·5—15
Females ..	15·5	77·5—78·5	48—49·5	14.5

In the May birds the organs were but partly enlarged. The females differ in plumage from the males only in the smaller extent of the red area about the base of the bill. The colour of the soft parts was in both sexes as follows :—iris dark brown ; mouth white; bill fleshy white, sometimes tipped with brown; legs fleshy brown.

The Gold-fronted Finch—*Serinus pusillus* (Pall.)

It was with particular pleasure that I first found this species on April 20th, as it had been for some years a special object of my search, and I was afraid that it would have left the Srinagar Valley before my arrival. On that day I found two large flocks at about 6,000 feet in a large open nullah of the line of hills behind Srinagar. These flocks were rather loose and straggling in character, the birds breaking away from or rejoining the others freely when disturbed. The ground that they were on was without trees, but covered with bushes and coarse herbage growing amongst a litter of boulders ; on settling they rapidly fluttered down to feed on the seed heads of the grass and other coarse herbage, or on the ground. In manner and demeanour they were very reminiscent of Gold-finches, and indeed a few days later I met with a mixed flock of both kinds considerably lower down, almost on the level of the plain, where they were feeding on an open stretch of short turf thickly covered with stones. Although shy and restless the two birds are easily differentiated in the field ; the Gold-fronted Finch appears very dark with a blackish looking head, and at a near approach the golden poll shines very brightly in the sun. The note is a clear double call, distinctive in character, but hard to describe ; the song is hardly more than a shrill warbling twitter, a more sustained version of the call note.

These flocks continued to frequent the same nullah for a few days but had apparently broken up or moved away by the 29th April, ; on that date I looked for them without success, although a few individuals were singing in the undergrowth about a small stream which ran down one side of the nullah.

Later, on May 4th, I found that about a dozen birds were frequenting a line of willow trees planted along a water channel on another part of the same range of hills, and these birds were in the same place on May 7th. Five specimens were obtained in all and in view of the comparative rarity of this bird in collections it may be as well to place their measurements on record.

No.	*Sex.*	*Date.*	*Bill from skull.*	*Wing.*	*Tail.*	*Tarsus.*	
3224	♂	20 April	9	75	57	15	Millimetres.
3237	♂ ?	24 April	10·5	75·5	54·5	15·5	,,
3266	♂	4 May	10	76	55·5	15·5	,,
3265	♂	..	10	75·5	54	15	,,
3284	♂	7 May	10·5	76	53·5	15	,,

No. 3224 is clearly an immature bird as the whole top of the head is a dull rufescent brown, faintly streaked with sooty black. The ear coverts are dull rufescent brown. The remainder of the plumage is similar to that of the adult males. There is some variation in the depth of colour of the gold poll in the adult birds, but this appears purely individual. The organs were minute in all the birds except that in No. 3284 they were very slightly enlarged. The soft parts are constant in colours as follows :—iris brown ; mouth whitish ; bill horny blackish, legs black. Nos. 3224, 3265 and 3266 show slight traces of moult about the head.

The White-capped Bunting—*Emberiza stewarti*, Blyth.

The White-capped Bunting was very common along the road from Kohala to Baramullah, and about the slopes of the Takht-i-Suliman and the range of hills

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behind it, where they were preparing to nest. I did not however see it on the Srinagar plain away from the hills. It is a matter of surprise to me that although I kept a careful watch over all the Buntings seen I could not detect a single specimen of *Emberiza cia stracheyi* amongst the numbers of this species.

The Grey-headed Bunting—*Emberiza fucata arcuata*, Sharpe.

On April 24th some seven or eight of these Buntings were found on the ground described above as the haunt of *Serinus pusillus*. They were rather shy and kept very much to the ground moving about amongst the herbage and I failed to secure a specimen.

The Swallow—*Hirundo rustica rustica*, L.

Throughout the journey of April 1st and 2nd the Swallow was observed in loose parties, in the hilly portion of the road often in company with the next species, hawking about the vicinity of the river. At Srinagar it was most abundant and curiously tame, settling within a few feet of the heads of passers-by in the verandahs of crowded places like the post office and the European shops along the Bund. By the middle of the month the birds were building or repairing old nests, some of which were placed in the smallest of native dwellings, so that they were easily within reach from the ground. The very publicity of the sites rendered it difficult to examine most of the nests, but I took a clutch of 5 fresh eggs on May 11th.

The Striated Swallow—*Hirundo daurica* (sub-sp?).

Observed in small numbers on April 1st and 2nd from Kohala to Baramullah, but only about the vicinity of Domel on the return journey of May 12th.

The Crag Martin—*Riparia rupestris* (Scop.)

Three or four individulals were seen over the hill behind Pendreathan on April 20th. On April 27th a large flight were flying around and resting on a rocky cliff of another part of the same range; these birds were apparently on passage, as when disturbed they immediately disappeared and did not return.

The House-martin—*Chelidon urbica* (sub-sp ?).

A few were seen hawking over the water-ways of the Dhal lake on May 6th.

The Tree Pipit—*Anthus trivialis harringtoni*, Witherby.

Small parties of Tree Pipits were seen about throughout the month of April, and a male which was shot on 3rd April proved to be of this race.

Hodgson's Pipit—*Anthus roseatus*, Blyth.

Several were observed about the floating gardens of the Dhal lake on April 8th when they were in company with Yellow-headed Wagtails. Two were seen in a ploughed field on April 23rd. Several pairs in breeding plumage were also seen usually near water, about the last week of April and into May.

The Brown Rock-Pipit—*Anthus sordidus jerdoni*, Finsch.

The Brown Rock Pipit was common about the Takht-i-Suliman and the bare lower slopes of the range of hills behind it, about 6,000 feet. Here they were in pairs and obviously about to breed, the courting flight being seen as early as April 9th.

The Grey Wagtail—*Motacilla cinerea melanope*, Pall.

A single bird was seen on April 5th. No more were seen until April 13th after which the species became fairly common on passage until about the end of the month, after which only two were seen, on May 8th.

The Cashmere White Wagtail—*Motacilla alba hodgsoni*, Blyth.

This handsome Wagtail was first seen on the upward journey of April 2nd about mile 48. In Srinagar it was common, but kept for the most part to the neighbourhood of the river and the Dhal lake where it was particularly partial

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to the house boats, being usually seen on their roofs; some might always be seen at the Dhal Darwaza feeding busily on the lumps of floating refuse which were continually being swept down by the fall of water. It was occasionally met with, sometimes in the company of other Wagtails, on flooded pastures. Pairs were seen carrying nesting material on April 22nd and May 3rd and in the former case the nest site was an old box on the roof of a house boat. On two occasions I saw the courting display; in this the cock shuffled round the hen, with the tail and wing nearest the latter spread out and sloped downwards, so that the upper surfaces were presented to the object of his affections.

Three males and three females were preserved and yield the following measurements:—

	Bill from skull.	*Wing.*	*Tail.*	*Tarsus.*
Males ..	17·5—18 mm	91—96	89—94	24·5—25
Females ..	17·5—18·5 mm.	87—93·5	84·5—90	23·5—25·5

The three males and one female appear to be full adults, and are practically identical in plumage except that the female has the pure black of the back somewhat sullied with ashy grey. All four birds have recently moulted the central pair of tail feathers. The other two females appear to be in their first summer plumage and have not moulted the central tail feathers. In both the back is ashy grey, somewhat mottled with black. All six birds were about to breed this year by the condition of the organs. The soft parts are:—iris dark brown; bill and legs black; mouth, blackish in males, tongue slaty-grey, in females fleshy or blackish livid.

The Masked Wagtail—*Motacilla alba personata*, Gld.

Observed occasionally for the greater part of April but I did not make very accurate notes on the appearance of this race, owing to the difficulty of distinguishing it in the field from some phases of *M. a. hodgsoni*.

The White Wagtail—*Motacilla alba alba*, L.

Occasional specimens of the White Wagtail were seen throughout the first half of April; two were seen as late as April 23rd and one of these last birds was secured. It is a male in summer plumage and is not distinguishable from European examples of this race.

The Yellow-headed Wagtail—*Motacilla citreola citreola*, Pall.

Met with in small numbers on various dates from April 13th to May 5th.

Hodgson's Yellow Wagtail—*Motacilla citreola calcaratus*, Hodgs.

Met with in small numbers on various dates from April 18th to May 6th.

The Cashmere Blue-throat—*Luscinia suecica abbotti* (Richm.).

Blue-throats, obviously on passage, were seen as follows:—April 4th two single birds, one in a garden and one in a willow grove, but not clearly identified were apparently Blue-throats; April 17th one amongst boulders at the foot of the Takht-i-Suliman; April 20th one seen; April 22nd one or two in the same place as on April 17th; April 28th one in the same place; May 4th one in an orchard tree. The last bird, a male, was shot and proves to be of the above-named race, to which presumably the other birds also belonged.

The Himalayan Ruby-throat—*Luscinia pectoralis* (Gould).

A female was shot on April 29th in a small bush—covered ravine with running water on the lower slopes of the range of hills behind Pendreathan.

The Magpie Robin—*Copsychus saularis* (L.).

Several were seen along the road about Garhi both on April 2nd and May 12th.

The Pied Wheatear—*Oenanthe picata* (Blyth).

A male was seen on April 9th on the boulder-strewn base of the hill near Pendreathan.

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The White-capped Wheatear—*Oenanthe capistrata* (Gould).

A male was seen at the base of the above range, but further along in the direction of the P. W. D. quarries on April 27th. A female Wheatear seen in the same direction on April 19th was also attributed to this species.

The Stone-chat—*Saxicola torquata indica*, Blyth.

On the upward journey of April 1st and 2nd the Stone-chat was observed throughout the road from Kohala upward and for the first half of April it was common about the fields and gardens about Srinagar. These birds were evidently on passage and had gone by the end of the month leaving only those birds on the lower slopes of the range of hills behind Srinagar which were about to breed between 5,500 feet and about 7,000 feet, and which had been present at the same time as the migrating birds in the fields below. A good deal of variation was observable in the colouration of the birds, some of the males appearing more uniformly black and white than others, and I regret that the limited time at my disposal did not allow me to collect a series for examination.

The Pied Bush-chat—*Saxicola caprata bicolor*, Sykes.

Abundant in the hills along the road from Kohala to Baramullah on both April 1st and 2nd and May 12th, but not observed at Srinagar.

The Iron-grey Bush-chat—*Oreicola ferrea ferrea* (Gray).

A male was seen at Garhi on April 2nd. One or two individuals, which might however have been only a single pair, were noted about the bund during the first half of April. A male was seen near the Takht on April 15th.

The Altai Accentor—*Prunella himalayanus* (Blyth).

A flock of some 15 to 20 of these Accentors was met with on the Takht-i Suliman on April 17th.

The Black-throated Accentor—*Prunella albigularis* (Brandt).

An Accentor was seen on the hillside by the Peri Mahal on April 15th which was apparently of this species.

Jerdon's Accentor—*Prunella strophiatus jerdoni* (Brooks).

A female was shot on April 29th in the same ravine and near the same place as the specimen of *Luscinia pectoralis*.

The Himalayan Whistling Thrush—*Myiophoneus temmincki temmincki* Vig.

Common along the road from Kohala to Baramullah on both April 1st and 2nd and May 12th. Single birds were observed near the Dhal lake on April 14th and April 28th.

Tickell's Ouzel—*Turdus unicolor*, Tickell.

Tickell's Ouzel was exceedingly common in Srinagar and was to be found throughout the gardens and camping grounds of the English quarter, and the willow groves and orchards of the surrounding country, but seldom ventured into the open fields or any distance up the hillsides. In habits and demeanour it resembles the English Song Thrush, and the mellow song was very reminiscent of the countryside at home. Many old nests placed in the forks and holes of trees were attributed to this species, but I did not find any new nest although courting was in full swing by the middle of April. Under its influence the birds became very pugnacious and were continually sparring.

The Black-throated Ouzel—*Turdus ruficollis atrigularis* Temm.

On April 2nd a few were seen along the road in the hill barrier between Gahri and Baramullah. At Srinagar small parties were met on different dates up till April 26th ; a single bird was seen on April 29th.

The Himalayan Pied Woodpecker—*Dryobates himalayensis* (Jard. & Selb.).

One was seen on April 11th in a willow grove by the Dhal lake and was heard in the same place some days later.

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The Wryneck—*Jynx torquilla japonica*, Bp.

I first observed the Wryneck on April 8th being attracted by the noisy behaviour of a pair in some old trees near the church ; after this the species was common and was frequently to be heard in civil lines, and the surrounding willow groves and orchards ; about the end of April the call was less frequently to be heard but the birds were still about and evidently intending to breed. Two specimens obtained are rather grey in tint.

The Pied Kingfisher—*Ceryle rudis leucomelanura*, Reich.

Observed occasionally on the Dhal lake throughout my stay.

The Common Kingfisher—*Alcedo atthis pallasii*, Rchb.

Kingfishers were exceedingly abundant in Srinagar throughout my stay. Their main stronghold was of course the confused labyrinth of plots of cultivation, floating gardens, and small channels, which lie between the Jhelum river and the Dhal lake, and to a lesser extent break up the margins of the lake itself. To thread this labyrinth in a "Shikara" was to meet with an endless succession of these beautiful birds, here sitting motionless on some bough close to the passing boat, there flying before it in fright uttering the familiar hard sharp squeak which is the call of the species. To leave the neighbourhood of the lake was not however to part with Kingfishers; anywhere throughout the surrounding plain small pools and dykes provided their quota, and even for a short distance up the hill sides occasional birds might be seen, attracted by some suitable nesting site on the face of the slope.

On my arrival the birds were already in pairs and many nest-holes were apparently ready for eggs: yet I was unable to find any hole containing eggs until May 8th on which date I took 7 fresh eggs from a burrow which had been found as early as April 8th, when the pair had been very noisy and tame, and apparently courting.

It is well known how dirty the burrows of this species become after the young are hatched, but it was new to me to discover that the entrance tunnel starts to grow dirty with the excreta of the parent birds, before the eggs are even laid.

Six adult specimens were preserved and their measurements are as follows :—

No.	*Sex.*	*Date.*	*Bill f. skull.*	*Wing.*	*Tail.*	*Tarsus.*
3198	♂	11th April	47	73	33·5	10·5
3221	♂	19th April	46·5	74	34	10
3240	♂	25th April	47·5	74	34	10
3225	♀	21st April	45·5	72	34·5	8·5
3241	♀	25th April	42·5	75·5	35·5	9·5
3287	♀	8th May	45	77	33·5	9

The sexes are alike in plumage : as regards the soft parts the dark brown iris the salmon mouth and the orange red feet with dusky claws are alike in both sexes. The bill is however very variable as follows :—

No. 3198 Black.

No. 3221 Blackish horn, a streak of salmon along sides of lower mandible.

No. 3240 Black, base of lower M. horny.

No. 3225 Blackish horn above, salmon horn below.

No. 3241 Upper mandible purplish brown, anterior half black ; lower salmon red.

No. 3287 Black, gape and lower surface salmon.

The clutch of seven eggs which were taken measure respectively :—21 x 17·5, 21 17, 21 x 17·5, 21 x 17·5, 20·5 x 17·5, 20·5 x 17·5, 20·5 x 17, mm.

The European Bee-eater—*Merops apiaster*, L.

The first Bee-eaters of the season were observed on April 22nd when a party of 8 were seen passing over head by the Gupkar gap, and a similar party was seen next day. By the end of the month the species had become common, their

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main stronghold being the open ground about the base of the Takht and the hills behind it. Numbers might also be seen over the reed beds of the Dhal lake. It is strange that I saw no Bee-eaters about the road on the return journey of May 12th.

The Hoopoe—*Upupa epops epops*, L.

On April 2nd we found the Hoopoe common as soon as we entered the plains at Baramullah and it was most abundant at Srinagar throughout my stay. About the end of April the birds were evidently preparing to nest in trees and in the walls of Kashmiri houses but I did not examine any nests.

The Cuckoo—*Cuculus canorus*, L.

The Cuckoo was heard calling once on each of the following dates, April 21st, April 26th and May 1st.

The Common Swift—*Cypselus apus*, L.

Observed as follows:—one over the summit of the Pendreathan hill on April 29th; several over the Dhal lake on May 6th; on the journey of May 12th one near Baramullah, two near Chakoti, and one at Domel.

The Slaty-headed Parrakeet—*Palæornis schisticeps*, Hodgs.

One was seen in a Chenar tree at Srinagar on April 13th. On the downward journey of May 12th several were seen in the hills below Baramullah, and a big flock was flying about the road at Domel.

The Himalayan Wood Owl—*Strix aluco nivicola* (Blyth).

I attribute to this species, which I have not previously met, a fine Owl seen sitting in a willow tree on the bund on April 10th and 11th. The remains of an owl which had been killed and eaten in some fir trees on a hillside was apparently of the same species.

The Lammergaier—*Gypaëtus barbatus grandis*, Storr.

Compared with the abundance of this grand bird about many of the hill stations the Lammergaier seemed very scarce in Cashmere. One was seen on both journeys, on April 2nd and May 12th in the hills between Ghari and Uri. At Srinagar I saw only a single example, on April 27th and April 29th, over the hill behind the P. W. D. stone quarry.

The Himalayan Griffon Vulture—*Gyps fulvus himalayensis*, Hume.

Observed in small numbers at Srinagar and about the road on both journeys.

The Egyptian Vulture—*Neophron percnopterus percnopterus* (L.).

Seen at Gahri on April 1st. At Srinagar one or two pairs were to be met about the neighbourhood of the Takht and the range of hills behind it, but the species was not common. On April 20th a nest containing eggs could be seen on a ledge of rock in a very narrow and precipitous gully at about 8,000 feet, but the site was quite inaccessible without the use of ropes.

Pallas's Fishing Eagle—*Haliaëtus leucoryphus* Pall.

A pair or possibly more were frequenting the neighbourhood of the Jhelum river just above Srinagar and were seen on various dates from April 21st until my departure.

The Booted Eagle—*Hieraëtus pennatus* Gmel.

A small species of Raptor which I doubtfully identify with this species was occasionally met with during the latter half of April, always in the neighbourhood of the river.

The Shahin Falcon—*Falco peregrinus peregrinator*, Sundev,

On April 16th a Wagtail that I had wounded on the camping ground near the rifle ranges was nearly taken by a Falcon which appeared by its flight and size to be a female Shahin.

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The Hobby—*Falco subbuteo*, L.

A party of 3 or 4 Hobbies were watched for some time on April 29th when they were soaring and playing about the bare summit, roughly 8,500 feet, of the hill behind Pendreathan. A small Falcon which was soaring over the river by the Post Office on the evening of May 4th was also, I think, of this species.

The Kestrel—*Falco tinnunculus*, L.

One or two were seen throughout the journey on April 1st and 2nd. One was seen on the return journey at Domel on May 12th.

At Srinagar occasional individuals were seen throughout the month of April.

The Larger Kite—*Milvus melanotis*, Temm. & Schl.

On the journey up on April 2nd I noticed the first nests of this Kite about the neighbourhood of Rampur, and they became more numerous as Srinagar was approached. In Srinagar the birds were common and the nests were not easy to secure as the majority of them were placed in the huge smooth limbed Chenar trees in situations that no climber could reach without ropes and ladders. These nests were for the most part very large solid structures, possibly added to from year to year, two or three times the size of the majority of the nests built in the plains by the common *Milvus govinda*.

A few nests were found in mulberry trees, at a comparatively low height, and these nests were but small and untidy. Two or three nests were also found in poplar trees.

The following clutches of eggs were actually taken. (The measurements in millimetres are appended) :—

April 7th : one fresh egg (nest not seen), 54·5 × 44·5.

April 9th : c/3 moderately incubated eggs taken from the side bough of a huge Chenar tree, only reached with rope and ladder after an hour's work. Nest large and massive. 59·5 × 46, 57·5 × 47, 56 × 48.

April 13th : c/2 moderately incubated eggs taken from one of three small mulberry trees growing on a small island in the middle of the Dhal lake. The nest was small and shallow and thickly lined with dirty rags and fragments of rubbish. 56 × 45 : 58 × 44·5.

April 13th : c/2 fresh eggs taken from a small nest on the summit of a medium sized mulberry tree. 55·5 × 44·5, 58·5 × 43.

April 19th : c/2 fresh eggs taken from a comparatively small and untidy nest built about 30 feet from the ground on the side bough of a small Chenar tree in a small farm yard on the river bank. Both birds came soaring round and attacked the climber in a very determined manner, stooping right through the branches at him, and on one occasion actually drawing blood from his scalp. 56·5 × 44·5, 57·5 × 45.

April 23rd : c/2 fresh eggs taken from a rather large nest built about 35 to 40 feet from the ground in one of a row of poplar trees on the golf course.

In Srinagar the Larger Kite is in no sense a jungle Kite but occupies exactly the place of *Milvus govinda* in the plains of the Punjab ; it is not however so numerous. The greater size and the white wing patches are very marked in most of the birds, but there are of course a large number of individuals which would hardly be distinguishable from the common species.

The Marsh Harrier—*Circus æruginosus* (L.)

Single examples of the Marsh Harrier were seen on April 13th, April 19th and April 30th.

The Blue Rock Dove—*Columba livia*, Bonnaterre.

Seen in small numbers, mostly about the hills, but no specimens were collected for subspecific identification.

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The Indian Turtle Dove—*Streptopelia orientalis meena* (Sykes).

One was seen about 8,000 feet near the summit of the hill behind Pendreathan on April 20th. Several were seen about the orchards and willow groves on April 25th and 28th and these were clearly migrating birds.

The Collared Turtle Dove—*Streptopelia decaocto, decaocto* (Frev.)

This familiar Dove was not seen until April 20th after which date the species rapidly became common.

The Spotted Dove—*Streptopelia suratensis suratensis* (Gm).

This Dove was not noted on my journey into Cashmere, nor in Srinagar; but on the return journey of May 12th it was found to be fairly common from Uri downwards.

The Snow-Cock—*Tetraogallus himalayensis*, G. R. Gray.

A pair were seen on April 20th at about 8,000 feet on the summit of the range of hills behind Srinagar. They were being pursued by a large Eagle, possibly Bonelli's Eagle, but the pursuit passed rapidly beyond my ken and the result remained unknown.

The Chukor Partridge—*Alectoris græca chukar* (Gray).

The Chukor Partridge was common enough on the range of hills behind Srinagar from about 6,000 feet upwards, but it was comparatively even more abundant on the Takht-i-Suliman; there the sacred traditions of the hill save the birds from molestation, and they have benefitted accordingly.

The Black-Partridge—*Francolinus vulgaris;* Steph.

Heard near Garhi on May 12th.

The Water-hen—*Gallinula chloropus* (L.)

The Water-hen appears to be a summer visitor to the Dhal lake as I only saw a single bird there (on April 13th) before April 25th on which date the species had become very numerous.

The Pheasant-tailed Jacana—*Hydrophasianus chirurgus* (Scop.)

Several were seen on May 8th about the marshes which lie on the southern side of the river near the Rifle Range. None were seen on the Dhal lake.

The Red-wattled Lapwing—*Sarcogrammus indicus* (Bodd.)

One was seen on April 6th at Srinagar.

The Black and White Stilt—*Himantopus candidus*, Bonn.

One was seen on April 16th on some flooded fields near the Rifle Range.

The Green Sandpiper—*Tringa ochropus*, L.

The Green Sandpiper was observed fairly common about the Happy Valley throughout the entire period of my stay in Cashmere.

The Common Sand-piper—*Tringa hypoleucus*, L.

This Sand-piper was observed occasionally about the Jhelum river on various dates from April 5th to May 5th.

The Wood Sandpiper—*Tringa glareola*, L.

A small number were observed about the marshes south of the river near the Rifle Range on both April 16th and May 8th.

The Common Heron—*Ardea cinerea*, L.

Observed in small numbers about Srinagar throughout my stay. Some were seen on the river near mile 94 on April 2nd.

The Night Heron—*Nycticorax nycticorax* (L.).

Observed as follows:—one in a line of osiers on the Dhal lake on April 25th; one or two about the Dhal lake on May 6th; one or two about the Mar Canal on May 9th.

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The Blackheaded Gull—*Larus ridibundus*, L.

On May 6th a party of some 20 Gulls in full breeding plumage with dark masks were seen on the Dhal lake, from whence they moved off towards the river. No specimen was obtained but there can be no doubt that they were of this species which I obtained at Jhelum in March 1914 when some numbers were moving up the Jhelum river on migration to their breeding quarters on the Salt lakes of Western Tibet.

The Whiskered Tern —*Hydrochelidon leucopareia indica* (Steph.).

The Whiskered Teru did not arrive until the end of April when I first saw a party flying down the river on the 30th of the month. Several were observed during the following days and when I visited Nasim Bagh by boat on May 6th numbers were observed fishing over the Dhal lake, especially over patches of weed. All were in full breeding plumage. The birds remained common until my departure on May 12th when they were observed in some numbers about the flooded fields of the Happy Valley as far as Baramullah ; none were seen below this.

The call is a harsh grating version of the syllable " Creak".

The Little Grebe—*Podieceps ruficollis capensis*, Salvad.

Three or four Dabchicks were seen on some ponds near the Baramullah road on April 8th. Single birds were seen on the Dhal lake on April 25th and May 6th.

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SUPPLEMENTARY NOTES ON THE *COCCIDÆ* OF CEYLON.

BY

E. ERNEST GREEN, F.E.S., F.Z.S.

PART IV.

(*Continued from page* 357 *of Vol. XVI of this Journal.*)

(*With* 39 *text figures.*)

The following notes and descriptions deal with new species of genera that were considered in the earlier parts of my Monograph. With the publication of part V, and the present paper, the list of Ceylon Coccidæ has been brought up to date. Other species, doubtless, remain to be discovered by any diligent collector. I should be glad to receive such novelties, with a view to the publication of further Supplementary Papers.

Aspidiotus ambalangoda, n. sp. (Fig. 1.)

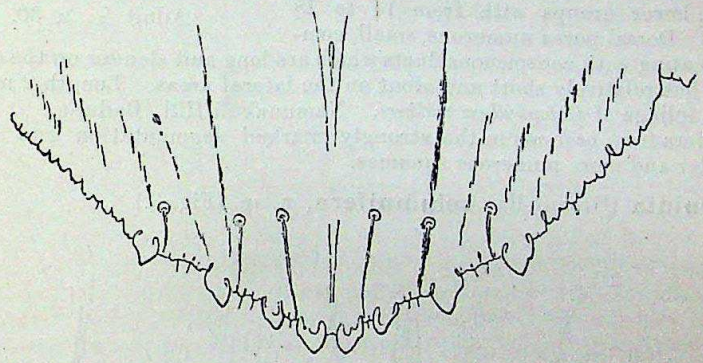

FIG. 1—*Aspidictus ambalangoda.* Pygidium of adult ♀, × 450.

Puparium of female flattish, oblong, much longer than broad, usually tapering to each extremity. Colour brownish black; larval pellicle reddish, surrounded by a narrow pale ring; nymphal pellicle concealed. Dimensions of fully developed example 2·25 by 1·5 mm.

Adult female rather strongly chitinized; broadly rounded in front, pointed behind, with a well defined transverse groove between the prothoracic and mesothoracic segments. No circumgenital pores. Dorsal pores minute and inconspicuous. Median area of pygidium more densely chitinous, with faint traces of partial tessellation. Extremity of pygidium with four pairs of prominent, bluntly pointed lobes each of which has a more or less distinct notch on the outer side; median and first lateral lobes approximately equal in size; second and third lateral lobes larger, widely separate; margin beyond outer lobes strongly cristate. Margin without squames. Spines small and inconspicuous. Paraphyses six, elongate, slender, each with a circular knob at its inner extremity. Length 1·5 mm.

Disposed along the mid rib, on the upper surface of leaves of an undetermined shrub. Ambalangoda.

Somewhat resembling *Pseudaonidia nigra* Brain; but differing in the absence of circumgenital pores.

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Aspidiotus calophylli, n. sp. (Fig. 2.)

Puparium of female pale brown, semi-translucent; flat, broadly ovate. Exuviae yellowish, sub-central.

Adult female turbinate; broadly rounded in front, acutely pointed behind. There is a slight lateral constriction demarking the thoracic from the abdominal areas. Segmental divisions strongly defined, especially those between the thorax and abdomen and between the abdomen and pygidium. Pygidium with three pairs of prominent lobes of which the median are the largest; median and first laterals distinctly trifoliate, second laterals bifoliate. Squames broad and deeply fimbriate; numerous, nine beyond the outer lateral lobe. Circumgenital pores in four groups; upper groups with from 15 to 23, lower groups with from 14 to 18 pores. Dorsal pores numerous, small, communicating with conspicuous ducts which are long and slender on the central area, but relatively short and stout on the lateral areas. Length 2 mm.

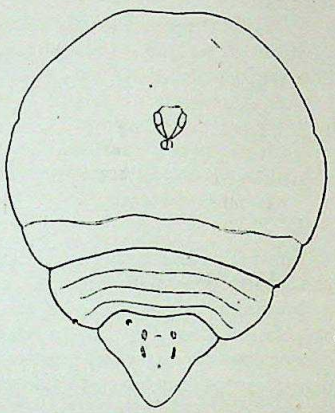

FIG. 2.—*Aspidiotus calophylli.* Adult ♀, × 30.

On foliage of *Calophyllum walkeri.* Namunakuli Hill, Badulla.

Differs from *pedronis* in the strongly marked segmentation and in the broader and more numerous squames.

Aonidia (Greeniella) **columnifera,** n. sp. (Fig. 3.)

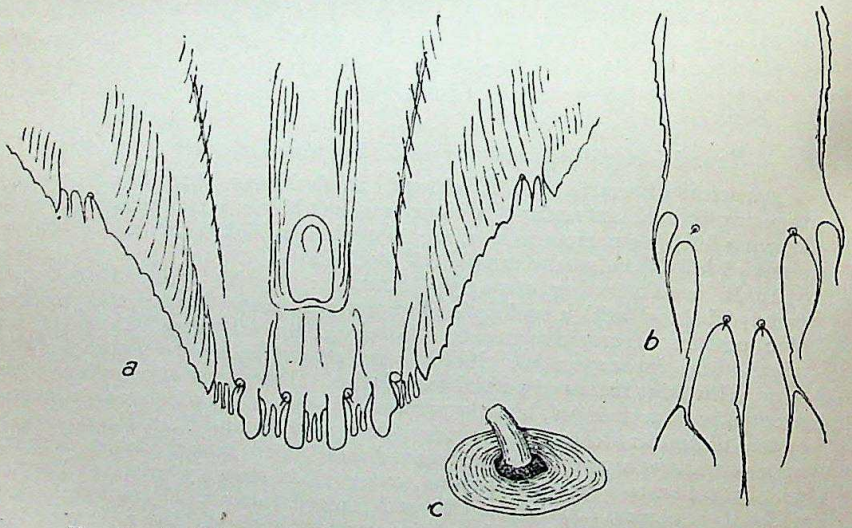

FIG. 3.—*Aonidia columnifera.* (*a*) Pygidium of nymph. × 450. (*b*) Pygidium of adult ♀, × 220. (*c*) Male puparium, × 10.

Puparium of female flattish, broadly oblate; dull castaneous; larval pellicle blackish, the central area occupied by a cylindrical column of dense, white wax which is often missing in old examples.

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Male puparium (*c*) very thin and flat; grayish; larval pellicle as in the female.

Adult female broadly oblate, more or less crescentic in outline. Pygidium (*b*) narrow; without any vestiges of pygidial lobes; the posterior margin produced into long flagellate processes; the sides (towards the base) narrowly cristate. Length 1 mm.

Pygidium of nymphal pellicle (*a*) with two pairs of prominent lobes; the median lobes parallel sided, entire; the lateral lobes gibbous, emarginate on the outer side; lateral margins strongly cristate.

On the under surface of leaves of *Turpinia pomifera*. Hakgala. (Coll. T. Petch).

Aonidia mesochitinosa, n. sp. (Fig. 4.)

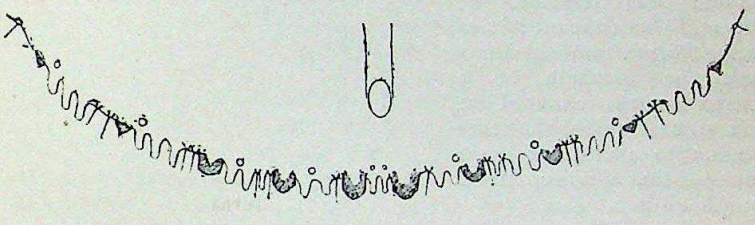

FIG. 4—*Aonidia mesochitinosa*. Pygidium of adult ♀. × 450.

Puparium of female bright castaneous; regularly ovoid, dorsal area slightly concave. Length 1 mm.

Adult female sub-circular, the pygidium not projecting, its outer margin evenly rounded. Cephalo-thorax with a large, circumscribed area more strongly chitinized. Anal orifice relatively large, at a distance from the posterior margin slightly greater than its longer diameter. Margin of abdomen with a close series of minute, bluntly conical tubercles. Margin of pygidium with five pairs of short but moderately broad lobes, of which the median are the largest, the others decreasing in size to the outermost; the three inner pairs obscurely notched on each side; the two outer pairs deltoid, entire; the fifth lobe is often missing on one or both sides. Squames short but relatively broad, emarginate. Spines projecting beyond the lobes. Length 0·5 to 0·6 mm.

On both surfaces of foliage of *Canthium montanum*. Hakgala. The puparia occupy distinct depressions which appear as raised spots on the opposite surface of the leaf.

Aonidia mimusopis, n. sp. (Fig. 5.)

Puparium of female small and inconspicuous; pale grayish ochreous, with a darker central area; broadly ovate, flat. Exuviæ concealed by the secretionary covering.

Pygidium of adult female with two pairs of broad and prominent lobes, the apices nearer

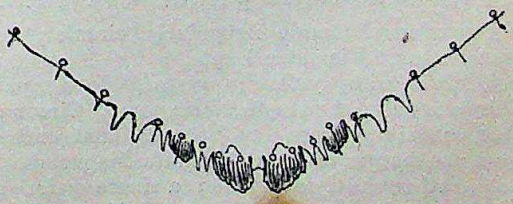

FIG. 5—*Aonidia mimusopis*. Pygidium of adult ♀, × 450.

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the inner side, their outer margins coarsely serrate; a pair of small, squamiform processes between the median and lateral lobes, and three similar but larger processes beyond the lateral lobe; marginal spines moderately long. Length of insect 0·5 mm.

Pygidial margin of nymph with two pairs of stout, prominent lobes, each indented on the outer side. There is a conspicuous lunate pore between the median and lateral lobes. and two others, on each side, beyond the lateral lobes.

On *Mimusops hexandra*. Trincomali. (Coll. T. B. Fletcher). The puparia are disposed along each side of the mid rib, on the under surface of the leaf.

Lepidosaphes dilatilobis, n. sp. (Fig. 6.)

Puparium of adult female flattish; pale stramineous; thin and translucent; two opaque (often reddish) lines mark the position of a median ventral channel on each side of which the scale extends to a width of more than half that of the channel. Length 1·5 mm.

Puparium of male paler and of more regular outline; posterior half depressed and slightly concave. Length 1·25 mm.

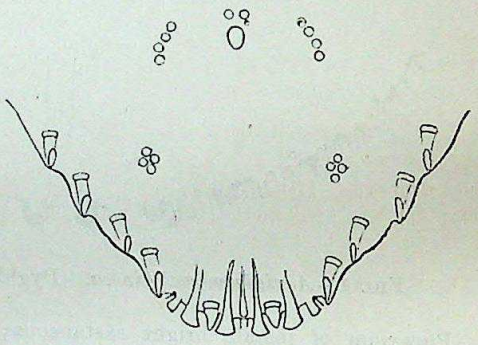

Fig. 6—*Lepidosaphes dilatilobis*. Pygidium of adult ♀, × 450.

Adult female of normal form. Margins of abdominal segments markedly produced; with many small pores, but without the usual spiniform squames. Pygidium bluntly conical; median and lateral lobes dolabriform, outwardly dilated, their bases extending inwards to a considerable distance. The lateral lobes are duplex, the outer lobule much smaller. The median and lateral lobes are separated by a single, stout, pore-bearing process. Circumgenital pores in five groups: median group with 2 pores, upper laterals with 3 or 4, lower laterals with 4; there is a considerable interval between the upper and lower lateral groups. Length 0·5 to 0·75 mm.

On undetermined shrub. Sigiriya and Ambalangoda. The scales are crowded, in irregular patches, on the undersurface of the leaves. Their presence is indicated by a purple-brown discoloration on the upper surface of the leaves.

Pseudoparlatoria pusilla, n. sp. (Fig. 7.)

Puparium of female irregularly circular, flat; pale yellow; thin and translucent. Diameter 1 mm.

Adult female yellow; ovate. Mouth parts large and conspicuous. Spiracles without parastigmatic pores. Circumgenital pores, in four groups, each containing from 8 to 9 pores. Anal orifice long ovate, at a distance from the margin of about twice its longer diameter. Median lobes trifoliate, rather widely separate; a single pair of duplex lateral lobes, the lobules simple; a pair of stout spiniform squames in the space between the median lobes, and a similar but smaller squame immediately outside both the median and lateral lobes. Marginal dorsal pores elongate, com-

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municating with short cylindrical ducts ; discal pores smaller, oval Length approximately 0·5 mm.

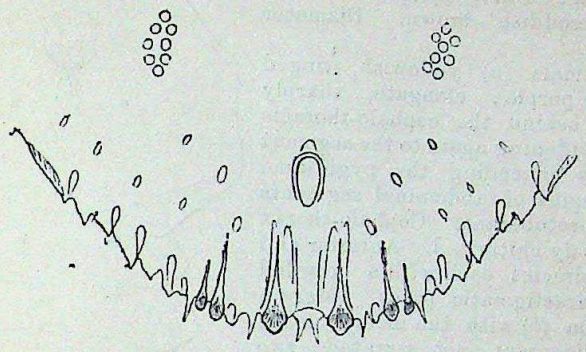

FIG. 7—*Pseudoparlatoria pusilla*. Pygidium of adult ♀, × 450

On *Theobroma cacao*. Peradeniya. The scales are extremely inconspicuous and are distributed, singly, at wide intervals, on the undersurface of the foliage.

Diaspis antiquorum, n. sp. (Fig. 8.)

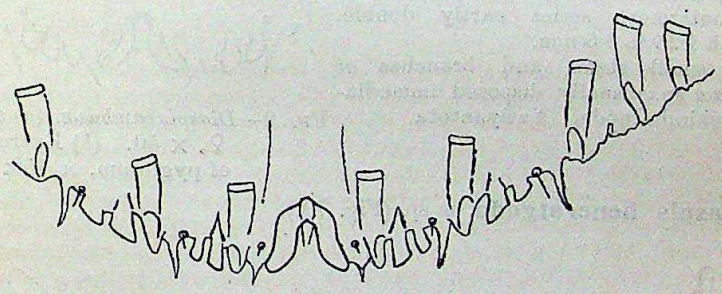

FIG. 8—*Diaspis antiquorum*. Pygidium of adult ♀, × 450.

Puparium of female sub-circular, moderately convex ; white, opaque ; exuviæ eccentric, larval pellicle bright castaneous, nymphal pellicle concealed. Diameter 2·5 mm.

Adult female broadly ovate, narrower behind. Pygidium with median lobes recessed, divergent, their bases confluent, their free margins very obscurely serrate ; two pairs of duplex lateral lobes, the lobules of the first pair narrowly dolabriform, those of the second pair broadly so, the inner lobule of each pair with a short inward extension defined by slender but densely chitinous paraphyses. Circumgenital pores in five large groups with numerous pores. Length 1·25 mm.

On the fleshy branches of *Euphorbia antiquorum*. Elephant Pass. Associated with *Parlatoria mangiferæ*.

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Diaspis bambusae. n. sp. (Fig. 9.)

Puparium of female circular, moderately convex; white, opaque; exuviæ eccentric, reddish brown. Diameter 2·5 mm.

Adult female (*a*) yellowish, tinged with dull purple; elongate, sharply contracted behind the cephalo-thoracic area, then widening again to the segment immediately preceding the pygidium; lateral margins of abdominal segments strongly protuberant. Cephalo-thorax rather densely chitinized. Anterior and posterior spiracles each with a crowded group of parastigmatic pores. Margin of pygidium (*b*) with the median lobes recessed, divergent, not serrated; two pairs of small, duplex, lateral lobes. Spiniform squames numerous and conspicuous on the base of pygidium and on lateral margins of the two previous segments. Circumgenital pores in five densely crowded groups which are almost confluent. Dorsal pores in four linear series, on each side; the innermost series containing 5 or 6 pores only, the outermost series partly double. Length 1·25 to 1·5 mm.

On small stems and branches of *Bambusa* sp.; usually disposed immediately behind a node. Yatiyantota.

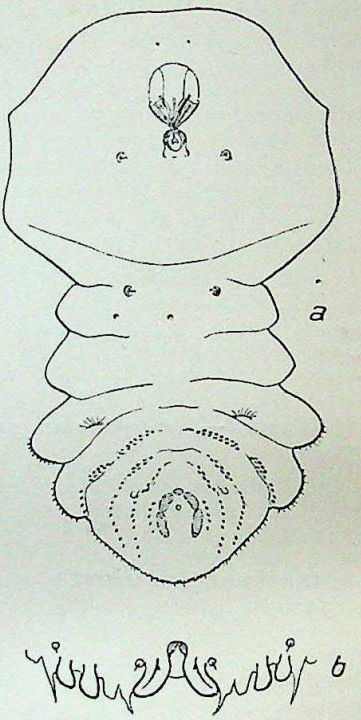

FIG. 9—*Diaspis bambusæ*. (*a*) adult ♀, × 50. (*b*) Extremity of pygidium, × 450.

Diaspis heneratgoda, n. sp. (Fig. 10.)

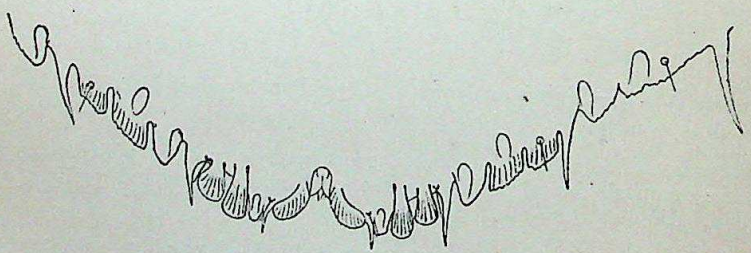

FIG. 10—*Diaspis heneratgoda*. Pygidium of adult ♀, × 450.

Puparium of female white, sometimes slightly tinged with ochreous; broadly ovate or sub-circular, flattish or moderately convex; exuviæ reddish brown, eccentric, close to the margin of the scale, the larval pellicle occasionally projecting beyond the margin. Longer diameter 2·5 mm.

Puparium of male white; weakly tricarinate; accompanied by some loose, white, woolly matter. Length 1 mm.

Adult female turbinate in outline, the abdominal segments tapering evenly to the extremity of the pygidium. Parastigmatic pores at ante-

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rior spiracles only. Pygidium with the mesal lobes relatively small, recessed, widely divergent, minutely serrate ; first lateral lobes relatively large, duplex, prominent, each lobule rounded at apex, the outer lobule as broad as or broader than the inner one; second lateral lobes in the form of broad, cristate prominences. Circumgenital pores in five groups, median group averaging 8, upper laterals 18, lower laterals 23. Dorsal pores in four conspicuous linear series, with an additional pair adjacent to the circumgenital pores. Length 1·5 mm.

On foliage of undetermined tree. Heneratgoda.

Diaspis orientalis, n. sp. (Fig. 11.)

Puparium of female white ; sub-circular, flattish, rather thin ; exuviæ central or slightly eccentric, very pale stramineous. Diameter 2·5 mm.

Male puparia white; with a strong median and weak lateral carinæ ; sometimes masked by a loose covering of woolly filaments. Length 1 mm.

Adult female (*a*) oblong; sharply contracted behind the cephalo-thoracic area ; the remaining segments narrowing, successively, to the pygidium. Cephalo-thorax and lateral protuberances of abdominal segments rather densely chitinized. Each spiracle with a small group of parastigmatic pores. Margin of pygidium (*b*) with the mesal lobes small, partly recessed, bluntly pointed, divergent, the inner edge obscurely serrate ; lateral lobes duplex, the first pair prominent, small, the two lobules of approximately equal size, their apices rounded or bluntly pointed ; second pair broader, each lobule with its apex at the inner side, their free edges serrate ; margin beyond the lobes strongly and deeply cristate. Circumgenital pores in five groups ; the mesal group averaging 18, upper laterals 32, lower laterals 24. Dorsal pores numerous, extending on to the free abdominal segments ; one or two close to the circumgenital pores, five curved linear series extending inwards from the margin, and four short series situated slightly above and overlapping the inner extremities of the longer series. Spiniform squames, on last abdominal segment and base of pygidium, small and inconspicuous. Length 1·25 to 1·5 mm.

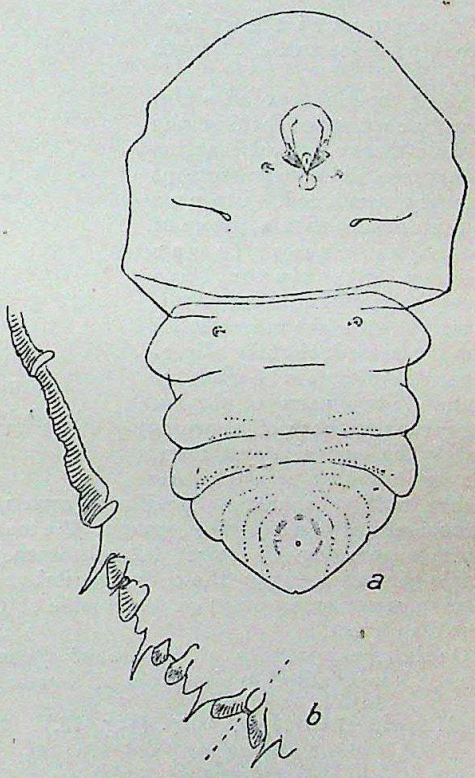

FIG. 11—*Diaspis orientalis*. (*a*) Adult ♀, × 50. (*b*) Margin of pygidium, × 450.

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On the undersurface of leaves of undetermined trees ; Maha Illuppalama and Galgammuwa. Also on *Sapindus* sp., Sigiriya. Received also from India, on *Hemigyrosa* sp.

Diaspis phoenicis, n. sp. (Fig. 12.)

Puparium of female broadly and irregularly ovate or subcircular ; flattish ; white, thin and semi-translucent ; exuviæ stramineous or very pale fulvous, eccentric, the larval pellicle often extra-marginal. Longer diameter 2 mm.

Male puparium white : strongly tri-carinate. Length 1 mm.

Adult female (*a*) oblong, sharply contracted behind the cephalo-thorax, lateral margins of last free abdominal segment strongly produced. Upper spiracles each with a group of parastigmatic pores ; lower spiracles with two or three pores only. Margin of pygidium (*b*) with the mesal lobes small, recessed, slightly divergent, their apices evenly rounded ; two pairs of duplex lateral lobes, both of approximately the same size and form, the two lobules of each pair rather widely separate. Spiniform squames small and inconspicuous. Circumgenital pores in five groups ; the mesal group with 8 pores, upper laterals averaging 15, lower laterals averaging 13. Dorsal pores few ; a single pore adjacent to the circumgenital groups, and three curved series (of five or six pores only) on each side of the pygidium. Length slightly less than 1 mm.

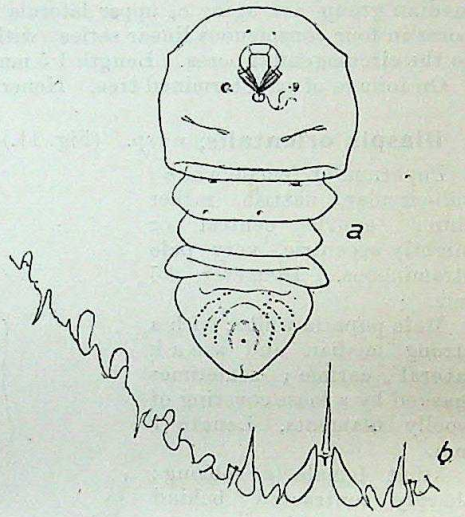

FIG. 12—*Diaspis phœnicis*.
(*a*) Adult ♀, × 50. (*b*) Pygidium, × 450.

On the upper surface of foliage of *Phœnix zeylanica* ; Maha Illuppalama. Nearly allied to *cinnamomi* of Newstead.

Diaspis mihiriya, n. sp. (Fig. 13.)

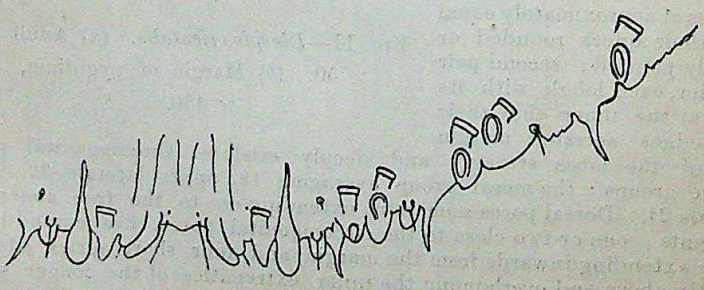

FIG. 13—*Diaspis mihiriya*. Margin of pygidium, × 450.

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Puparium of adult female pale ochreous, opaque; very irregularly circular or broadly ovate, very slightly convex; exuviæ eccentric, often projecting beyond the margin. Average diameter 1·75 mm.

Male puparia snowy white, very obscurely tricarinate, thickly covered with dense white secretionary matter which completely conceals the exuviæ. Collected into close clusters of from 4 to 15, with their anterior extremities directed towards the centre of the cluster. Length 1·25 mm.

Adult female sub-circular, the pygidium broadly rounded; abdominal segments moderately protuberant. Spiracles small and obcure, without parastigmatic pores. Pygidium with the mesal lobes widely separate, recessed, narrow, excurved; lateral lobes duplex, each lobule rather broadly rounded, the inner lobule of the first pair projecting beyond the mesal lobes; a pair of long slender spines in the space between the mesal lobes, spiniform squames extending on to the margins of the free abdominal segments. Circumgenital pores in five crowded groups; mesal group of type individual containing 27 pores, upper lateral groups with 40 and 36, lower lateral groups with 31 and 33. Dorsal pores large and conspicuous, extending on to the abdominal segments, but those on the latter area of smaller size than those on the pygidium. Diameter 0·75 mm.

On foliage of *Dichopsis grandis*; Bogawantalawa.

Diaspis grandilobis, n. sp. (Fig. 14.)

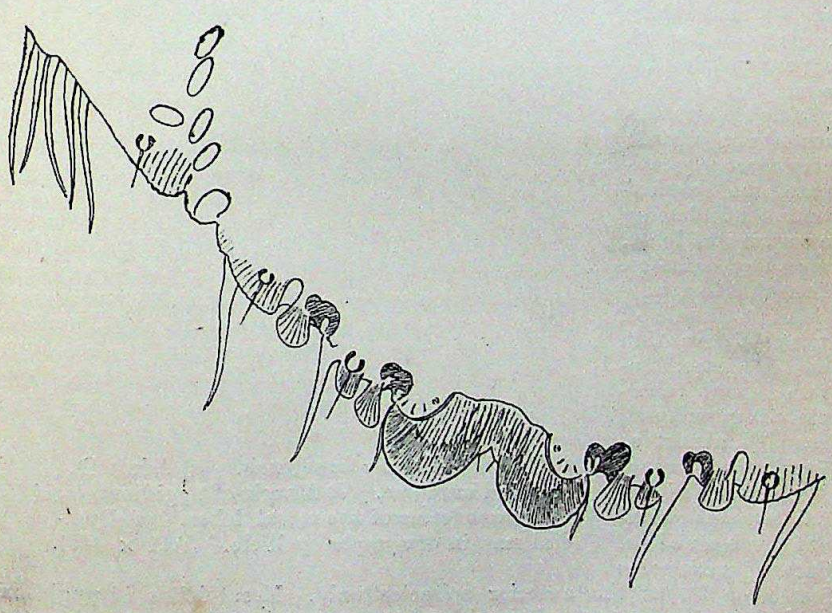

FIG. 14—*Diaspis grandilobis*. Margin of pygidium, × 450.

Puparium of female similar to that of *pentagona*; colour creamy white, exuviæ reddish. Diameter 2 mm.

Adult female. Form similar to that of *pentagona*. Parastigmatic pores at each spiracle, but more crowded at the anterior pair. Mesal lobes of pygidium very large and dense; their bases confluent; their free margins

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prominent, broadly rounded, minutely but obscurely crenulate. Lateral lobes duplex, the outer lobule of the second pair represented by a broad cristate marginal prominence. A pair of short, dense broad paraphyses on each side, situated in the intervals between the lobes. Spiniform squames large and conspicuous, numerous on the base of the pysidium and on the margins of the abdominal segments. Circumgenital pores in five crowded groups, each group with from 60 to 80 pores. Dorsal pores extending on to the thoracic segments, those on the pygidium larger. Length 1·25 to 1·75 mm.

On the smaller branches of *Diospyros Thwaitesii*; Peradeniya. Near *flacourtiæ*, but differing in the form of the mesal lobes and in the presence of prominent lateral lobes.

Fiorinia kandyensis, n. sp. (Fig. 15.)

Puparium of female consisting solely of the nymphal pellicle which is of a bright castaneous colour, with a darker median longitudinal fascia; elongate, moderately convex. Length approximately 1·5 mm.

Male puparia scattered; white; very obscurely carinate, the carinations concealed by a covering of loose, woolly matter. Length 0·75 mm.

Adult female of normal form; thin and delicate. Interantennal tubercle (*a*) prominent, rounded, almost as long as it is broad. Margin of abdominal segments without tubercles. Parastigmatic pores few (2 or 3), at the anterior spiracles only. Mesal lobes of pygidium small, varying in form; often with a narrow, prominent process at the apex (*b*), or coarsely serrated (*d*), or bifid (*c*). Lateral lobes represented by irregular marginal incrassations. Spiniform squames broad, tapering to a point. Spines setiform, unusually long and slender. Circumgenital pores forming an irregular arch containing between 60 and 70 pores. Dorsal pores few, small and inconspicuous, confined to the marginal area of the pygidium. Length approximately 0·75 mm.

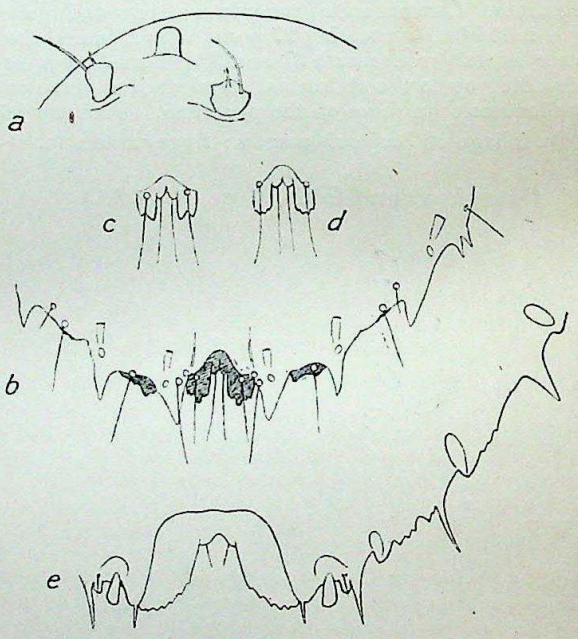

FIG. 15—*Fiorinia kandyensis*. (*a*) Adult ♀, frons and antennæ. (*b*) Margin of pygidium, (*c*, *d*) different forms of the mesal lobes. (*e*) Pygidial margin of nymphal pellicle. (All × 450).

On the undersurface of leaves of an undetermined shrub; Kandy.

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The species is well characterized by the unusually long setiform spines on the margin of the pygidium.

Chionaspis acuminata atricolor, n. var.

It will be convenient to give a varietal name to this very constant form.

The puparium is of a deep castaneous brown, that of the type form being ochreous or pale fulvous.

On foliage of *Carissa* sp., Maha Illuppalama ; and on an undetermined plant, Kandy. Received also from Southern India, on *Carissa* and *Tamarindus.*

Chionaspis gynandropsidis, n. sp. (Fig. 16.)

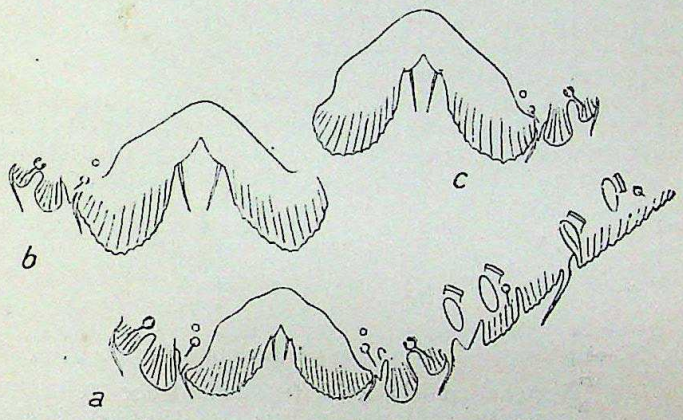

FIG. 16—*Chionaspis gynandropsidis.* (*a*, *b*, *c*). Various forms of the pygidial lobes, × 450.

Puparium of female white, exuviæ bright fulvous ; elongate, sinuous, broadest posteriorly. Length 2·25 mm.

Adult female reddish yellow ; ovate, broadest across the abdomen. A small group of parastigmatic pores at the anterior spiracles only. Mesal lobes of pygidium varying considerably in size and form (*a*, *b*, *c*), large, divergent, partly recessed, their bases confluent, their free margins finely serrate ; first lateral lobes well developed, duplex, the inner lobule dilated, sometimes projecting beyond the mesal lobes (as at *a*), but usually shorter (*b*, *c*) ; second lateral lobes represented by broad, cristate, marginal prominences. Spiniform squames few and small. Circumgenital pores in five groups ; mesal group with from 8 to 10 pores ; upper laterals averaging 24 ; lower laterals averaging 23. Oval dorsal pores conspicuous, four linear series on each side of the pygidium, with similar but smaller pores grouped on the margins of the abdominal and thoracic segments. Length 1 to 1·25 mm.

On stems and branches of *Gynandropsis* sp.; Peradeniya. Very near *subcorticalis*, from which it may be distinguished by the much stronger development of the first lateral lobes, and by the smaller spiniform squames.

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Chionaspis linearis, n. sp. (Fig. 17.)

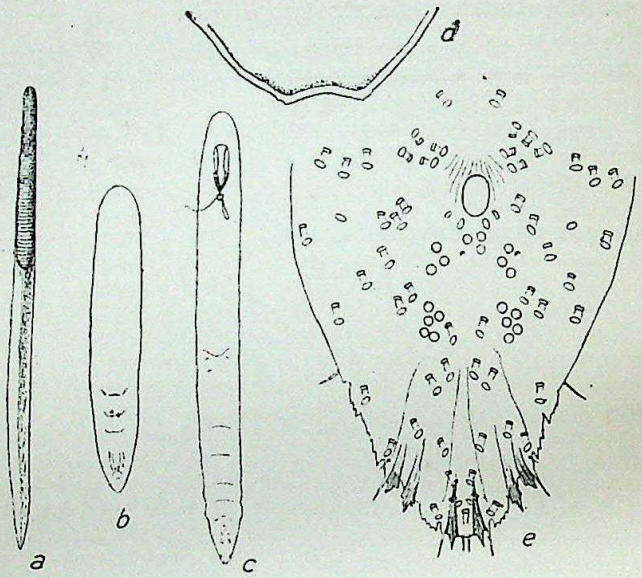

FIG. 17.—*Chionaspis linearis.* (*a*) Puparium of adult ♀, × 30.

(*b*) Nymphal pellicle, × 50. (*c*) Adult ♀, × 50. (*d*) Posterior extremity of larval pellicle, × 450. (*e*) Pygidium of adult ♀, × 450.

Puparium of female (*a*) white, the exuviæ pale stramineous; very long and narrow, filiform, posterior extremity tapering to a point, secretionary appendix with a median longitudinal ridge. Length 2 mm. Breadth approximately 0·1 mm. Nymphal pellicle (*b*) elongate, narrow. Posterior margin very similar to that of the adult insect. Length 0·75 mm. Posterior extremity of larval pellicle (*d*) without lobes or processes. Length 0·5 mm.

Adult female (*c*) long and slender; pale yellow. Pygidium (*e*) pointed with a mesal pair of narrow hastate lobes, rather widely separate, and two lateral lobes, of the same form, on each side. The lateral lobes are approximate to each other, but are separated by a considerable interval from the mesal lobes. Spiniform squames very slender. Margin weakly cristate for a short distance beyond the outer lateral lobes. Anal orifice relatively large, situated near the base of the pygidium. Circumgenital pores in five groups; mesal group 2 or 3, upper laterals 3, lower laterals 4 or 5. Oval dorsal pores associated with short ducts; numerous, scattered, not disposed in definite series. There is a single median pore between the mesal lobes. Length 1 mm.

On the margins of the leaves of a small species of Bamboo; Peradeniya. Allied to *annandalei*, from which species it differs, principally, in the possession of circumgenital pores.

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Chionaspis tenera, n. sp. (Fig. 18.)

Puparium of female white ; very thin and delicate ; elongate, narrow, gradually widening to the middle and then more abruptly narrowing to the posterior extremity ; with a median longitudinal channel due to the fact that the scale lies in the sunken median vein of the leaf. Larval pellicle pale straminеous ; nymphal pellicle colourless, concealed. Length 2·25. Greatest breadth approximately 1 mm.

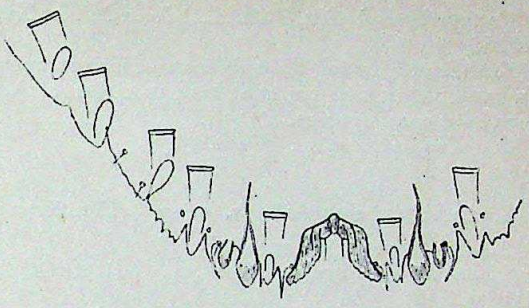

FIG. 18.—*Chionaspis tenera.* Margin of pygidium, × 450.

Male puparium without, or with very obscure carinæ.

Adult female pale yellow ; elongate, narrow. Pygidium with the mesa lobes narrow, recessed, widely divergent, their bases confluent, their free margins minutely serrate. A single pair of prominent, duplex, lateral lobes, the base of the inner lobule extended inwards. Spiniform squames few, small and inconspicuous ; none on the base of the pygidium, or margins of abdominal segments. Circumgenital pores in five small groups ; median group with 3 or 4 pores, upper laterals with 7 to 12, lower laterals with 10 to 15. Oval dorsal pores few, but large and conspicuous, in short series of 2 or 3 pores only. Length 1 to 1·5 mm.

Disposed along the sunken mid rib, on the upper surface of foliage of an undetermined shrub ; Maha Illuppalama.

Parlatoria cingala var. **namunakuli,** n. var. (Fig. 19.)

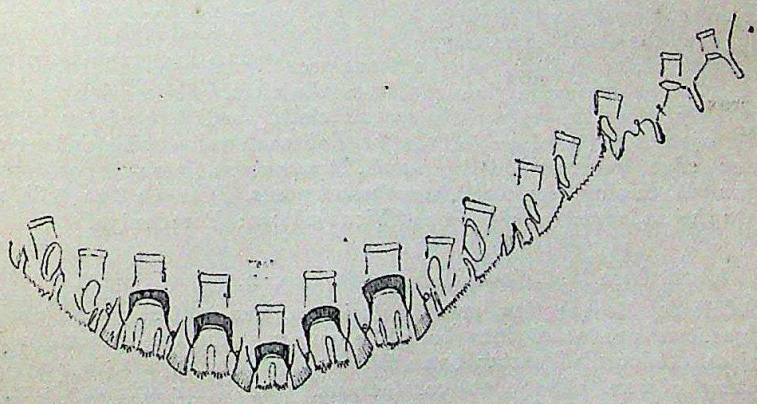

FIG. 19.—*Parlatoria cingala namunakuli,* Pygidium of adult ♀, × 450.

Differing from the type in the structure of the outermost lobe on each side of the pygidium of the adult female. In typical *cingala* this lobe is large and broadly rounded. In var. *namunakuli* it is small and lanceolate.

On leaves of an undetermined shrub : Namunakuli Hill, Badulla.

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Parlatoria rutherfordi, nom. nov.

Parlatoria zeylanica, Ruthfd., 'Journ. Bom. Nat. Hist. Soc.' xxiv., p. 114, (1915.)

Rutherford having described two distinct species, under the same name, on two consecutive pages of his paper (loc. cit.), a new name is necessary for the second species.

On *Cinnamomum*, sp. Peradeniya.

Lecanium desolatum, n. sp. (Fig. 20.)

Adult female irregularly ovate, often narrowed in front, flattish. At first yellowish green, with an interrupted. brown, medio-longitudinal stripe; the margin with a radiating series of narrow brownish streaks. In older examples the dorsum becomes suffused with reddish brown, leaving a broad, pale, median fascia. Dorsum pitted with polygonal depressions containing concentric, superimposed, waxy plates. Dead and dried examples uniformly pale castaneous. Antennæ 7-jointed; 3 and 4 equal, longest, the division between these two joints indistinct. Eye spots marginal. Tarsus about three-quarters the length of the tibia. Marginal setæ (*a*) curved, flattened and slightly dilated at the distal extremity. Stigmatic clefts shallow, with a translucent, wedgeshaped break in the denser chitin projecting inwards from the cleft. Stigmatic spines three in the first cleft, two only in the second cleft, small but relatively stout. Anal operculum (*b*) elongate, the base of each valve twice as long as its outer edge, surrounded by small, translucent, tear-shaped streaks. Derm with minute, scattered, translucent pores. Length 3 to 3·75 mm.

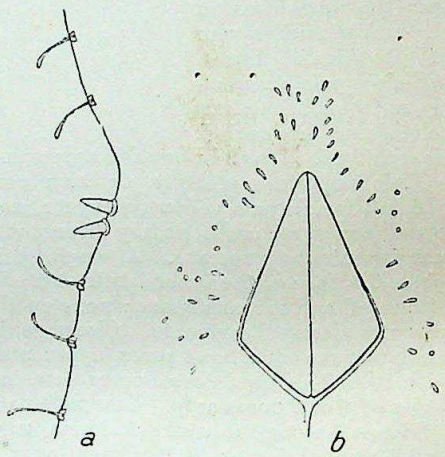

FIG 20.—*Lecanium desolatum*. (*a*) Marginal setæ and stigmatic spines, × 450. (*b*) Anal operculum, × 130.

On the undersurface of leaves of Ficus *gibbosa*: Peradeniya.

Lecanium (Platylecanium) **fusiforme,** n. sp. (Fig. 21).

Adult female (*a*) flat, broadly fusiform, the anterior and posterior extremities produced into beak-like points. Surface smooth, without carinæ. Colour dull castaneous. Old examples with a thin, colourless coating of wax. Eye spots conspicuous, placed far within the margin. Antennæ small, rudimentary, with from 3 to 4 joints. Limbs absent. Anal operculum (*c*) small, pointed, longer than broad, the base of each valve approximately equal to its outer edge. Marginal setæ minute, few, widely separate. Stigmatic clefts (*b*) deep, broadly rounded, margined inwardly with a narrow chitinous band. A long, slender, translucent streak extends inwards from each cleft. Stigmatic spines three, stout, long, all of approximately the same size. Marginal area with numerous, small,

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rounded or irregular cells, followed by a sub-marginal zone of larger and and more crowded cells, the latter with a tendency to a polygonal form. Dorsum with small translucent pores, each set in a small, denser chitinous spot, the whole forming an obscurely tessellated pattern. Length 3·75 to 4·5 mm. Greatest breadth 2·5 to 3·5 mm.

On the upper surface of foliage of an undetermined shrub : Ambalangoda.

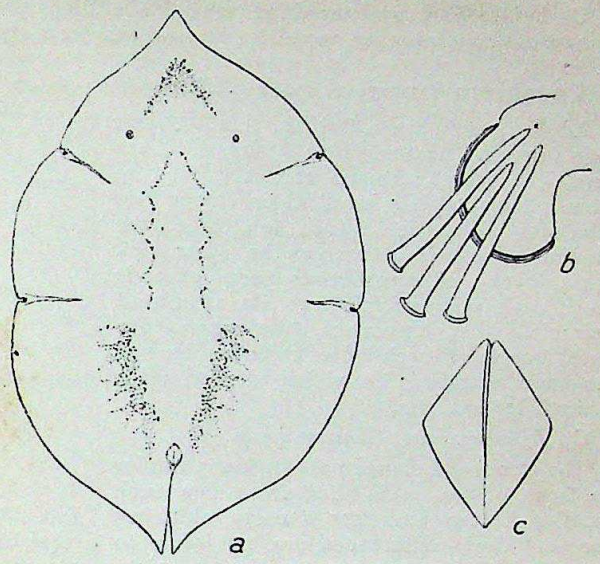

FIG. 21—*Lecanium fusiforme.* (*a*) Adult ♀, × 18. (*b*) Stigmatic cleft and spines, × 450. (*c*) Anal operculum, × 130.

Lecanium illuppalamæ, n. sp. (Fig. 22.)

Adult female broadly ovate, moderately convex. Colour ochreous or reddish, mottled with brown. Antennæ 7-jointed ; 3 and 4 longest and approximately equal. Limbs well developed ; tarsus about three-quarters the length of the tibia. Anal operculatum typically quadrate (*a*), occasionally oblate (*b*). Marginal setæ unusually long ; simple, except at the posterior extremity of the body, where some of them are deeply forked (*e*), the hindmost seta (one on each side of the anal cleft) is stouter and spiniform. Stigmatic clefts shallow, containing from 3 to 5 spines (*c*, *d*) of which the central one is very much longer than the others. Dermal cells small and inconspicuous ; circular, scattered. Length 2·5 mm.

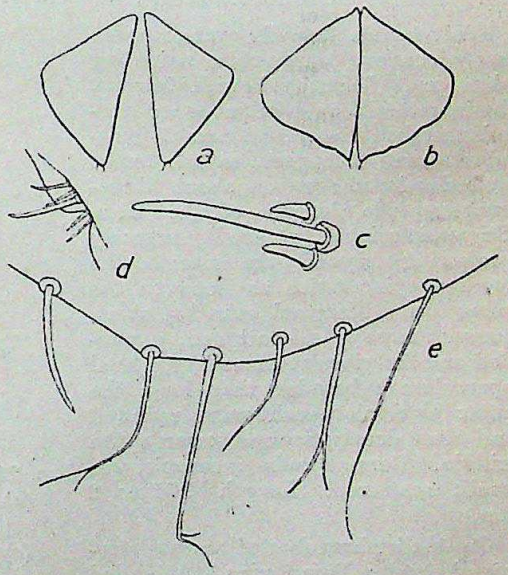

FIG. 22—*Lecanium illuppalamæ.* (*a*) Anal operculum, typical form, × 130. (*b*) Anal operculum, varietal form, × 130. (*c*, *d*) Stigmatic spines, × 405 and 220. (*e*) Posterior margin, with setæ, × 450.

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On twigs of an undetermined tree; Maha Illuppalama. Differing from *discrepans* in the longer, more slender and simpler marginal setæ.

Lecanium ixoræ, n. sp. (Fig. 23.)

Adult female ovate, flattish, thin. Colour pale fulvous. Antennæ 6 to 7 jointed. Legs small but robust; tarsus almost as long as tibia. Marginal setæ small, their extremities ciliated. Stigmatic spines (*a*) three, the median spine twice as long as the other two. A single row of conspicuous pores extends from each stigmatic cleft to its associated spiracle. Anal operculum (*b*) elongate, the basal margin of each valve twice as long as its outer margin. No visible dermal cells. Length 1·5 to 2 mm.

On *Ixora coccinea*; Heneratgoda.

The structural characters are very similar to those of *Lec. psidii*; but *ixoræ* is a much smaller, flatter and less densely chitinous insect. These differences are not due to immaturity. The specimens under examination were fully developed and contained ova. The complete absence of dermal cells is a distinguishing character.

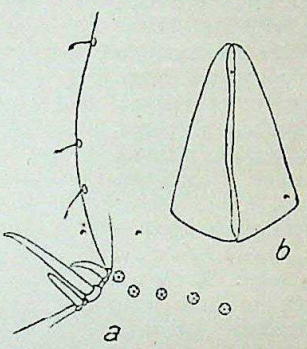

FIG. 23—*Lecanium ixoræ*. (*a*) Stigmatic spines and marginal setæ, × 450. (*b*) Anal operculum, × 130.

Lecanium latioperculatum, n. sp. (Fig. 24.)

Adult female broadly ovate, moderately convex; derm soft, wrinkling when dry. Colour yellowish fulvous, the intestinal loop visible as an irregular reddish line. Antennæ 7-jointed; 3 and 4 longest, equal. Limbs well developed; tarsus about three-quarters the length of the tibia. Stigmatic spines (*a*) small, scarcely projecting beyond the margin, the median spine twice as long as the other two; Marginal setæ (*b*) short, curved; more or less flattened, expanded and fimbriate at extremity. Anal operculum (*c*) broader than long, the outer margin of each valve rounded and often deeply incised towards the middle. Dermal cells inconspicuous, small, scattered. Length 1·75 to 2 mm.

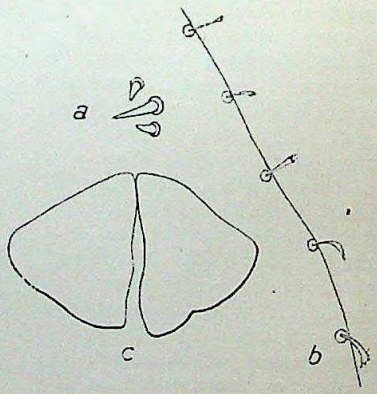

FIG. 24—*Lecanium latioperculatum*. (*a*) Stigmatic spines, × 450. (*b*) Marginal setæ, × 450. (*c*) Anal operculum, × 130.

On smaller branches of an undetermined shrub; Peradeniya. Attended by ants (*Œcophylla smaragdina*); and often included in their silken enclosures.

Examples from Batticaloa have the marginal setæ more slender and less distinctly fimbriate.

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Lecanium (Paralecanium) **limbatum**, n. sp.

Adult female broadly ovate; flat. Colour bright castaneous, the marginal area and a medio-longitudinal fascia darker. Dorsum with five or six inconspicuous hyaline streaks, on each side, extending inwards from the margin. Venter with a sharply defined, broad, denser marginal zone. Antennæ 6-jointed; 3rd longest, 6th elongated. Limbs small but fully developed; the tarsus less than half the length of the tibia. Valves of anal operculum sharply pointed, basal margin shortest. Margin minutely crenulate. Marginal flabellæ broadly rounded, overlapping. Stigmatic spines three, long and slender, bluntly pointed. Length 3 mm.

On *Ixora coccinea*; Batticaloa.

Differing from *calophylli* in the crenulate margin, in the absence of prominent quadrate processes beneath the flabellæ, and in the smaller number of hyaline streaks radiating inwards from the margin.

Lecanium (Paralecanium) **mancum**, n. sp. (Fig. 25.)

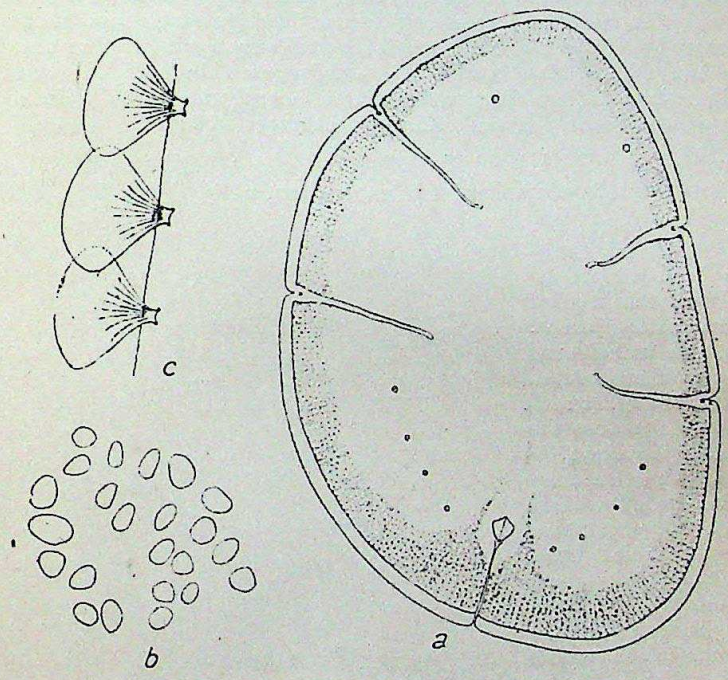

Fig. 25—*Paralecanium mancum*. (*a*) Adult ♀, dorsal aspect, × 18 (*b*) Dermal cells, × 220. (*c*) Marginal flabellæ, × 450.

Adult female (*a*) flat, deltoid, with rounded angles, usually asymmetrical, always narrower in front. Colour dark castaneous, with a narrow hyaline border and with hyaline canals extending inwards from each stigmatic cleft. Dorsum with more or less well defined, thin, colourless, polygonal, waxy plates. Eye spots conspicuous; at some distance from the margin. Antennæ relatively short, articulation obscure. Limbs entirely wanting. Anal operculum sub-quadrate, the base of each valve slightly shorter than its outer edge. Stigmatic spines three, blunt, the median spine usually shorter than the other two. Marginal flabellæ (*c*) sub-triangular in form, the outer edge flatly curved, the converging sides approximately straight.

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Margin, between the flabellæ, very obscurely crenulate. Derm of dorsum with definite series of minute pores, (associated with small setæ) demarking the areas occupied by the waxy plates. Submarginal area crowded with irregularly rounded dermal cells (*b*). A curved series of from four to five small groups of translucent vacuoles extends forwards from each side of the anal orifice. Length 4 to 4·5 mm. Breadth across abdomen 2·75 to 3 mm.

On *Calophillum walkeri*. Namunakuli Hill, Badulla.

Lecanium piperis var. **namunakuli,** n. var.

Differing from the type in having 6-jointed antennæ, two of the segments being suppressed to form a single, long third joint. The stigmatic spines are in groups of 3 (instead of 4 or 5). Length 4 to 4·5 mm.

On *Piper* sp. Namunakuli Hill, Badulla.

Lecanium tessellatum var. **obsoletum,** n. var.

Differing from the type in the almost complete suppression of the tessellation, only the merest traces of which are distinguishable, and that only in the more heavily chitinized examples. It is very much smaller and less robust than typical *tessellatum*. The anal operculum is slightly smaller. The stigmatic clefts are deeper and more sharply incised. Colour pale fulvous; translucent. Length of largest example 1·75 mm.

On *Myrtus communis*: Matale.

Lecanium (Paralecanium) **trifasciatum,** n. sp. (Fig. 26.)

Adult female (*a*) flat, broadly rounded, subcircular, the margin indented on the frontal and stigmatic areas. Colour pale translucent green, with three, broad, reddish brown, transverse bands across the dorsum. Antennæ 6-jointed, the articulations indistinct. Limbs well developed; tarsus longer than tibia. Anal operculum (*b*) longer than broad; the basal slightly shorter than the outer margin; the apices acutely pointed. There are two compact groups of pores on each side, on a level with the anal operculum. Stigmatic clefts (*c*) deep, their sides densely chitinous. Stigmatic spines three, cylindrical, blunt. A single row of pores extends from each cleft to its associated spiracle. Eye spots not distin-

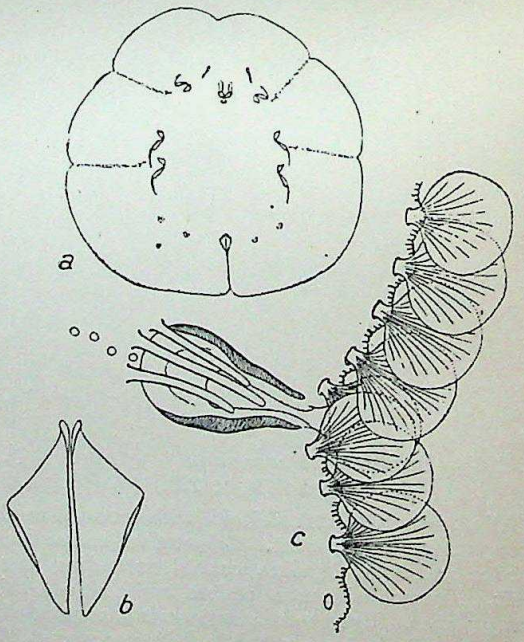

FIG. 26.—*Paralecanium trifasciatum*. (*a*) Adult ♀, × 18. (*b*) Anal operculum × 130. (*c*) Stigmatic cleft and marginal flabellæ, × 450.

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guishable. Margin (*c*) sinuous and obscurely crenulate; the flabellæ crowded, overlapping by nearly half their diameter. Diameter 2·25 mm.

On foliage of *Hemicyclea*: Batticaloa.

In form and general appearance closely resembling *P. expansum*, from which it is distinguished by the presence of well developed limbs. It is probable that the examples examined, though adult, were not fully developed and that the colouration may assume a more uniform tint in later life. If, at the same time, the insect increases in size the flabellæ would be more widely separated and would not overlap to the same extent.

Lecanium tripartitum, n. sp. (Fig. 27.)

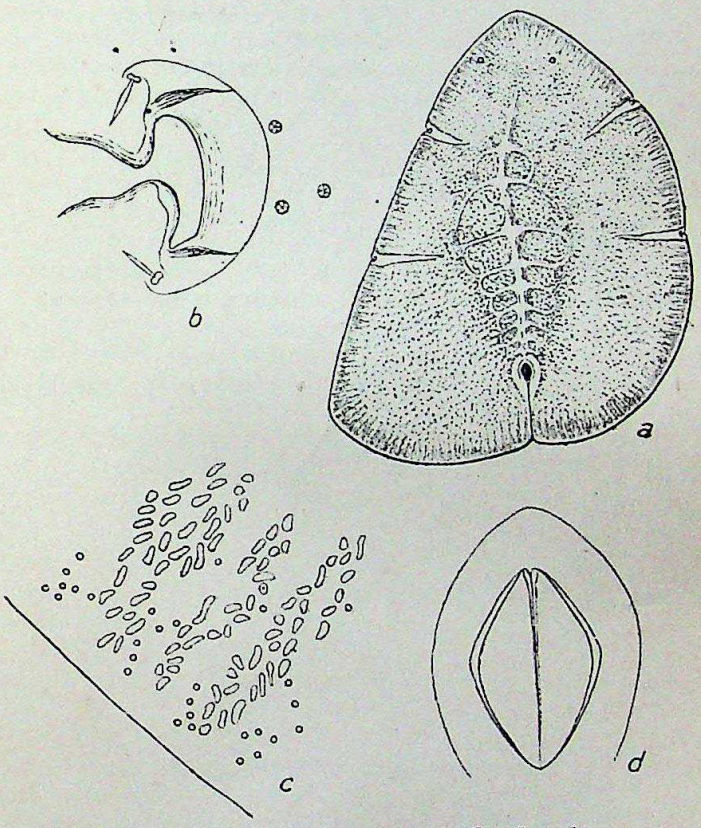

FIG. 27.—*Lecanium tripartitum*. (*a*) Adult ♀, dorsal aspect, × 10. (*b*) Stigmatic cleft, × 450. (*c*) Marginal area, with pores and dermal cells, × 80. (*d*) Anal operculum, × 130.

Adult female (*a*) bright castaneous; highly polished—as if coated with varnish; very flat, with shallow median longitudinal carina giving off, on each side, eight or nine inconspicuous branches which curve round and meet each other, enclosing a series of shallow sunken areas. Form deltoid, asymmetrical, rather sharply pointed in front, widest across the posterior extremity. Antennæ 6-jointed, 3 longest, 6 only slightly longer than 5. Limbs small but fully developed; tarsi of first and second legs shorter than the tibiæ, those of the third pair equal to the tibiæ. Stigmatic clefts (*b*) with a broad, lunate, strongly chitinized inner rim at each extremity of which is a single (occasionally two) lanceolate spine. Anal operculum

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(*d*) lozenge-shaped: longer than broad; bordered by a broad, strongly chitinized, hoop-shaped band with sharply defined margins; valves with thickened margins; the whole surrounded by an irregular translucent space. Derm with scattered circular pores and numerous small, irregularly shaped, translucent maculæ (*c*). Length 5·5 to 5·75 mm.; greatest breadth 4·75 to 5 mm.

On foliage of *Calophyllum walkeri*; Namunakuli Hill, Badulla.

The character of the stigmatic clefts is peculiar, in which respect it approaches *L. marsupiale*, but from which it is otherwise very distinct.

Lecanopsis ceylonica, n. sp. (Fig. 28.)

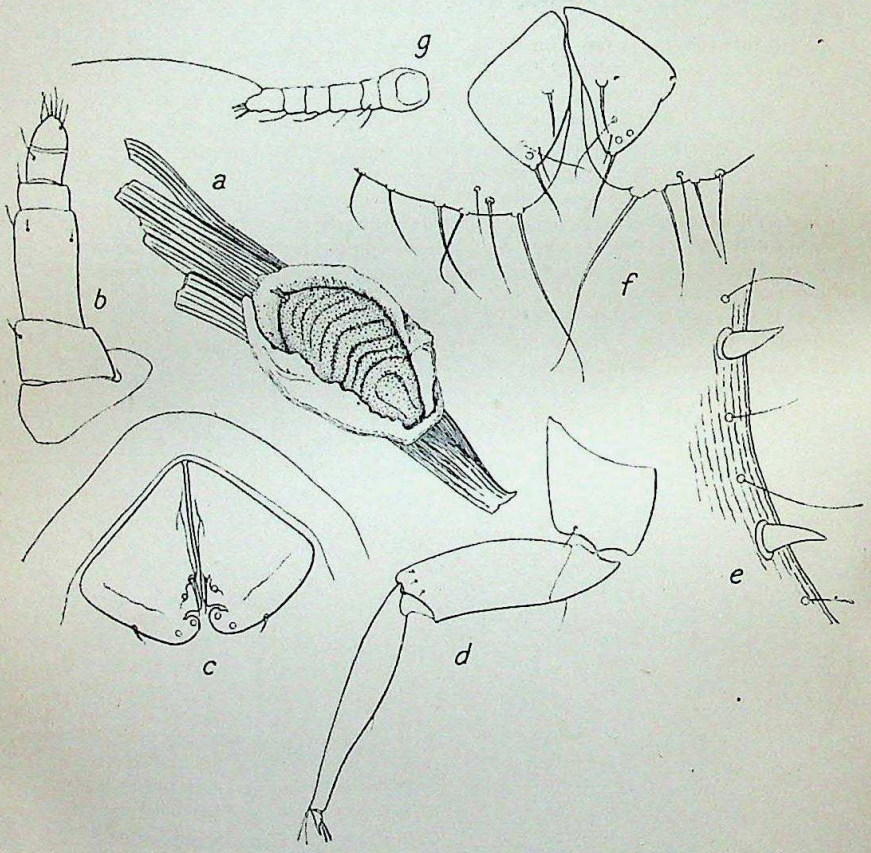

FIG. 28.—*Lecanopsis ceylonica*. (*a*) Adult ♀, in situ, × 12. (*b*) Antenna, × 220. (*c*) Anal operculum, × 130. (*d*) Third leg, × 130. (*e*) Stigmatic spines, × 220. (*f*) Posterior extremity of early nymph, × 220. (*g*) Antenna of larva, × 220.

Adult female (*a*) surrounded and partially covered by a white felted test. Insect broadly ovate, narrower in front; strongly convex above; with a deep, transverse furrow behind the cephalothorax; the next two segments deeply, the remainder shallowly furrowed. Colour ochreous yellow, dull, opaque. Dorsum coarsely punctured, more particularly on the abdomen. Antennæ (*b*) short and stout, 6-jointed, the 3rd longer than the terminal three together. Limbs (*d*) well developed; the tibia

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and tarsus completely fused together without trace of division. Tarsal digitules slender, minutely knobbed; ungual digitules slightly dilated. Anal operculum (*c*) oblate; the base of each valve longer than its outer edge, the apices incurved; a stout spiniform seta on the inner edge of each valve; three or four circular cicatrices, nearer the apex, suggest the earlier presence of other similar setæ; a broad, sharply defined densely chitinous hoop surrounds the upper half of the operculum. Margin with long, slender setæ, most of which (in the example under examination) are indicated by their basal sockets only. No stigmatic clefts; but the margin, opposite each spiracle, bears two, widely separate, stout, acuminate, irregularly conical spines (*e*). Derm without conspicuous cells, but with scattered circular pores and small setae. Length 2·5 mm.

Nymph with antennæ and limbs similar to those of the adult insect. Valves of anal operculum (*f*) with apices bluntly pointed and bearing a longish stout seta mounted on a small tubercle; a similar seta within the inner margin, about half way between the apex and the base, and indications of lost setæ on the apical half. Margin with many strong setæ, becoming longer snd stouter towards the extremity of the body. Stigmatic spines similar to those of the adult insect.

Larva with stigmatic spines as in the later stages. Antenna (*g*) 6-jointed, the 6th with a very long lateral seta that exceeds the length of the antenna itself. Tarsus and tibia of approximately equal length. Margin with short curved setæ, increasing in length towards the posterior extremity.

At the base of a grass plant, below a large stone, on patna land; attended by ants. Pattipola. Described from a single adult female, and several nymphs and larvæ.

Exaeretopus farinosus, n. sp. (Fig. 29.)

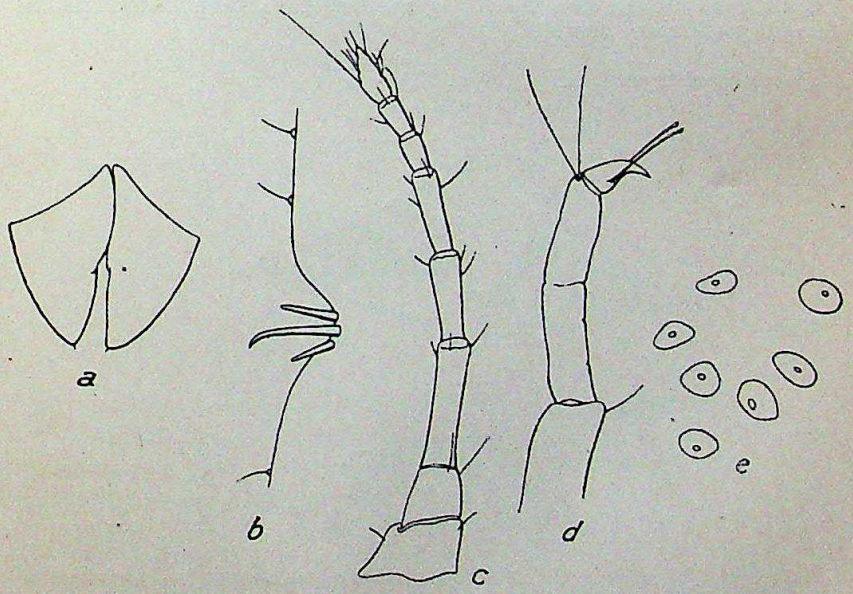

FIG. 29.—*Exaeretopus farinosus.* (*a*) Anal operculum, × 130. (*b*) Stigmatic cleft, spines and setae, × 220. (*c*) Antenna, × 130. (*d*) Tarsus of anterior leg, × 220. (*e*) Dermal cells, × 220.

Adult female olivaceous or slaty gray; the dorsal surface thickly dusted with white, mealy secretion. Form elongate ovate, moderately convex; divisions of abdominal segments clearly defined, in the living insect

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Antennæ (*c*) 8-jointed, 3, 4 and 5 elongate, 3rd longest—equal to the terminal three together. Legs well developed ; the tarsus approximately half as long as the tibia, often more or less bowed ; tarsus of anterior leg (*d*) usually with an incomplete division at about half its length ; claw large, strong and falcate ; tarsal digitules long and slender, minutely knobbed ; ungual digitules long, narrow, dilated at the extremity. Anal operculum (*a*) as broad as it is long ; the basal margins slightly concave, the outer margins convex ; apices bluntly pointed. Stigmatic clefts (*b*) shallow, with three stout spines, the median spine longest and curved at its extremity, the outer spines straight and bluntly pointed. Marginal setæ simple, slender, larger towards the posterior extremity of the body. Derm of dorsum crowded with irregularly circular or ovate, conspicuous cells (*c*), often filled with dark granular matter, moderately large, each cell opening onto the surface by a small oval pore. There is an irregular, medio-longitudinal series of small, discoid pores on the dorsum, extending from shortly in front of the anal operculum to the base of the abdomen. Venter with some longish, stout setae, arranged in a double median series on the abdomen, somewhat scattered on the thoracic area, and in a transverse group below the point of insertion of the antennæ. Length 3·5 to 4·5 mm.

On the young stems and foliage of *Psychotria bisulcata* : Namunakuli Hill, Badulla.

This species has been assigned, somewhat doubtfully, to the genus *Exaeretopus*, in the type species of which there are no stigmatic spines. But the characters of the limbs and antennæ are more in accordance with that genus than with *Lecanium*. The absence of any ovisac precludes a position in *Pulvinaria* with which, otherwise, the characters are in close agreement.

Chalcid parasites, bred from this species, have been determined as *Coccophagus flavescens* How.

Ceronema fryeri, n. sp. (Fig. 30.)

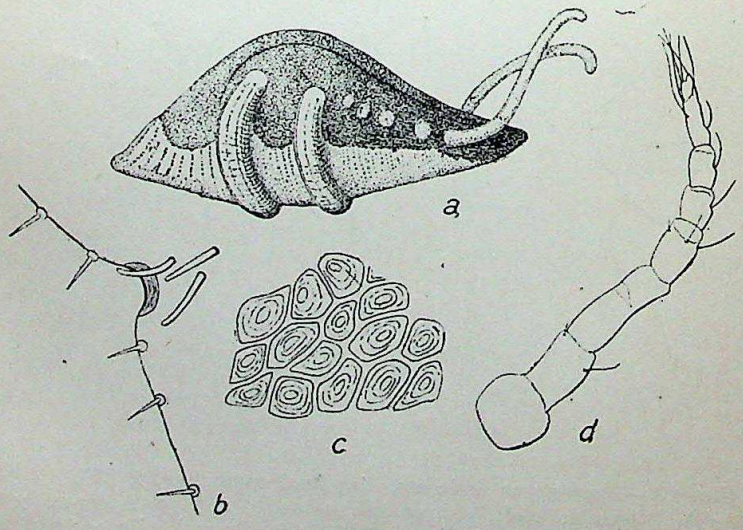

FIG. 30.—*Ceronema fryeri.* (*a*) Adult ♀, side view, × 7. (*b*) Stigmatic cleft and spines, × 220. (*c*) Dermal cells, × 130. (*d*) Antenna, × 220.

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Adult female (*a*) ovate, highly convex, depressed posteriorly ; with a strongly marked rounded tumescence on each side of the dorsum. Colour dull olivaceous brown, dusted with mealy secretion which is condensed into a thick covering on the marginal area. Dense, vertical, waxy bands, of an ochreous white colour, arise from the stigmatic areas on each side, extending far onto the dorsum. A long, stout, curling, white filament arises from near the posterior extremity, on each side, extending upwards and backwards. Several waxy spots, on each side of the abdomen, possibly mark the position of other similar filaments that have been lost. Derm deeply and closely pitted. Antennæ probably 8-jointed, normally ; in the example under examination the antennae are 7-jointed (*d*), the long third joint showing indications of incomplete division. Limbs and antennae relatively small and weakly chitinized. Tarsus rather more than half the length of the tibia ; tibiotarsal articulation very indistinct tarsal digitules slender, knobbed ; ungual digitules slightly dilated. Anal operculum small, ovate, the base and outer margin of each valve together forming an even curve. Margin with a distant series of small, slender spines. Stigmatic clefts (*b*) shallow, inwardly bordered with a lunate chitinous plate ; stigmatic spines three, rather slender, of approximately equal length. Dorsum closely crowded with large, irregularly polygonal, dermal cells (*c*). Length 8 mm.

On an unidentified shrub: Maha Illuppalama. Described from a single example collected by Mr. J. C. F. Fryer to whom I am pleased to dedicate this fine species.

Ceronema iceryoides, n. sp. (Fig. 31.)

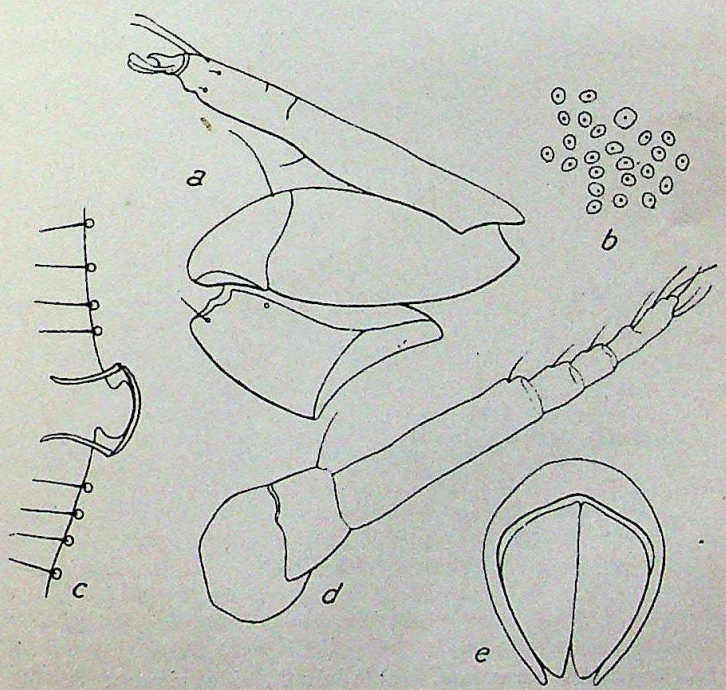

FIG. 31—*Ceronema iceryoides*. (*a*) Anterior leg, × 220. (*b*) Dermal cells × 220. (*c*) Margin, with stigmatic cleft, × 220. (*d*) Antenna × 220. (*e*) Anal operculum, × 130.

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Adult female superficially resembling *Icerya aegyptiaca*. Dorsum covered with cushions of pulverulent, white, waxy secretion; margin with a loose fringe of long, white, curling waxy processes. After denudation the insect is of a broadly ovate form, wider behind. Antenna (*a*) 6-jointed, the 3rd greatly exceeding the length of the terminal three joints together. Limbs (*a*) relatively small, but robust; tibio-tarsal articulation wanting or incomplete. The suppressed joint indicated by a slight infolding of the outer margin at about one third of the length from the distal extremity; claw stout and strongly falcate; tarsal digitules slender, knobbed; ungual digitules broadly dilated. Stigmatic clefts (*c*) shallow but sharply defined; lunate; with a moderately stout, curved spine at each extremity of a narrow curved plate that borders the inner margin of each cleft. Margin with a close series of slender, spiniform setæ. Anal operculum (*e*) oboyate, the outer angles evenly rounded; almost completely encircled by a sharply defined, narrow, densely chitinous plate. Derm of dorsum crowded with small, circular or ovate cells (*b*), each cell enclosing a minute pore. Length of denuded insect 3·5 mm.

On an undetermined plant; Putalam.

Described from a single example that was put aside as a specimen of *Icerya aegytiaca*. It was only after denudation, in potassium hydrate, that its Lecaniid character was revealed.

Ctenochiton cinnamomi, n. sp. (Fig. 32.)

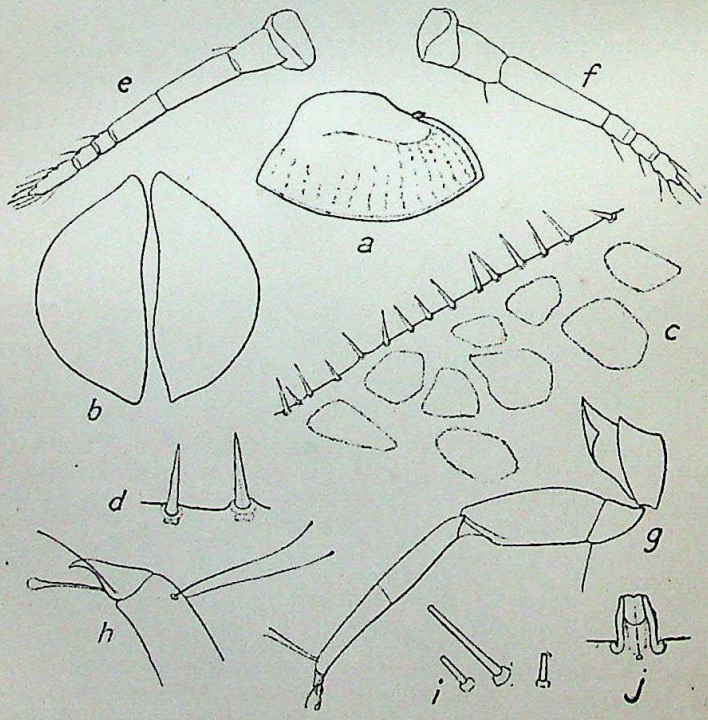

FIG. 32—*Ctenochiton cinnamomi*. (*a*) Adult ♀, side view, × 8. (*b*) Anal operculum, × 130. (*c*) Margin, with spines and dermal cells, × 220. (*d*) Marginal spines, × 450. (*e*) Antenna, 7-jointed form, × 130. (*f*) Antenna, 8-jointed form, × 130. (*g*) Mid leg, × 130. (*h*) Foot, × 450. (*i*) Stigmatic spines, × 450. (*j*) Tubular pore, × 450

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Adult female (*a*) superficially resembling *Lecanium oleæ*, but without conspicuous carinæ. Sub-circular or broadly ovoid; strongly convex, apex flattened, sides sloping steeply; margins of anal cleft prominent. Colour dark purplish brown, closely studded with irregular, colourless, glassy granules, giving the insect a frosted appearance. Margin densely chitinous; irregularly indented and wrinkled. Antenna either 6 or 7-jointed; in the 6-jointed form (*f*) the 3rd equals or exceeds the length of the three terminal joints together; in the 7-jointed form (*c*) the 3rd and 4th are elongated. Legs (*g*) rather slender; the tarsus approximately equal to the tibia; tibia and tarsus together markedly longer than femur and trochanter; tarsal digitules slender, knobbed; ungual digitules unequal, one slender and the other broadly dilated at the extremity (*h*). Anal operculum (*b*) approximately circular, the base and outer margin of each valve forming an even curve; surrounded by a narrow, densely chitinized zone. Margin with a close fringe of stout, acute spines (*c*, *d*). No stigmatic clefts; but opposite each spiracle is a group of three slender, cylindrical, truncate spines (*i*), of which the median is more than twice as long as either of the other two. Derm with large, irregularly polygonal cells (*e*). There is a distant, submarginal series of large, prominent, tulenlar pores (*j*), and a few similar pores scattered over the dorsolateral area. Length (under compression) 3 to 4·5 mm.

On *Cinnamomum* sp., Colombo; and on an undetermined tree, Chilaw.

Ctenochiton fryeri, n. sp. (Fig. 33.)

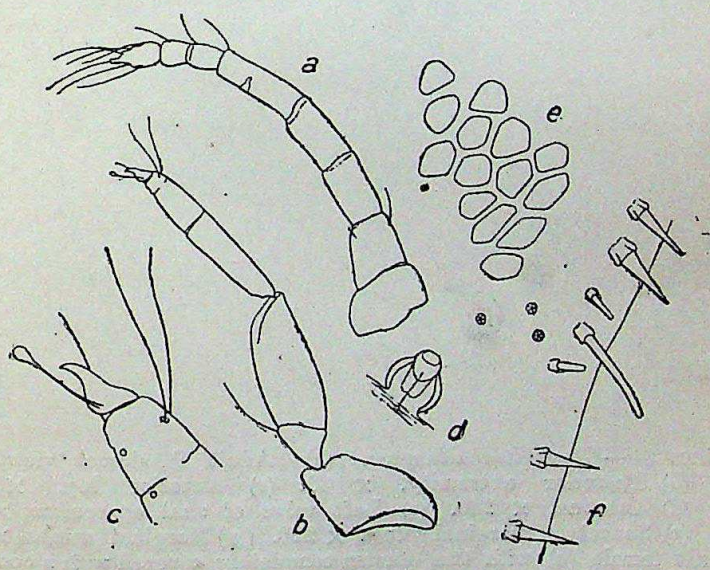

FIG. 33—*Ctenochiton fryeri*. (*a*) Antenna, × 130. (*b*) Mid leg, × 130. (*c*) Foot, × 450. (*d*) Tubular pore, × 450. (*e*) Dermal cells, × 220. (*f*) Marginal and stigmatic spines, × 450.

Adult female ovate, depressed or moderately convex. Colour pale castaneous; the dorsum studded with irregular, colourless waxy granules; the granules projecting, on the margin, in the form of irregular delnticues. Antennæ (*a*) 8-jointed; the 5th longest and with an imperfect division which—if complete—would add a ninth joint; 6th and 7th shortest. Limbs (*b*) rather small, but well developed; tarsus approximately three quarters the length of the tibia; there is a false joint in the tarsus, shortly behind the digitules; tibia and tarsus together of same length as femur and tro-

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chanter; tarsal digitules slender, knobbed; ungual digitules (*c*) unequal, one slender, the other stouter and distally expanded into a circular disc. Rostrum large and conspicuous. Margin (*f*) with a close fringe of stout, acutely pointed spines. No stigmatic clefts; stigmatic spines three, cylindrical, truncate, the median spine about three times as long as either of the other two. Dorsum crowded with moderately large, irregularly polygonal and rounded dermal cells (*e*). At intervals along the submarginal area, and distributed irregularly over the dorsum, are some conspicuous, prominent, globular, tubular pores (d). Anal operculum large; approximately circular; surrounded by a narrow, densely chitinous zone. Length 2·75 to 3 mm.

On the bark of an undetermined tree: Vavuniya. Collected by Mr. J. C. F. Fryer.

Closely allied to *Cten. cinnamomi*; but differing in the number of antennal joints, in the proportions of the tibia and tarsus, in the size of the dermal cells, and in the form of the tubular pores. (Compare figs. 32 and 33.)

Ctenchiton olivaceum. n. sp. (Fig. 34.)

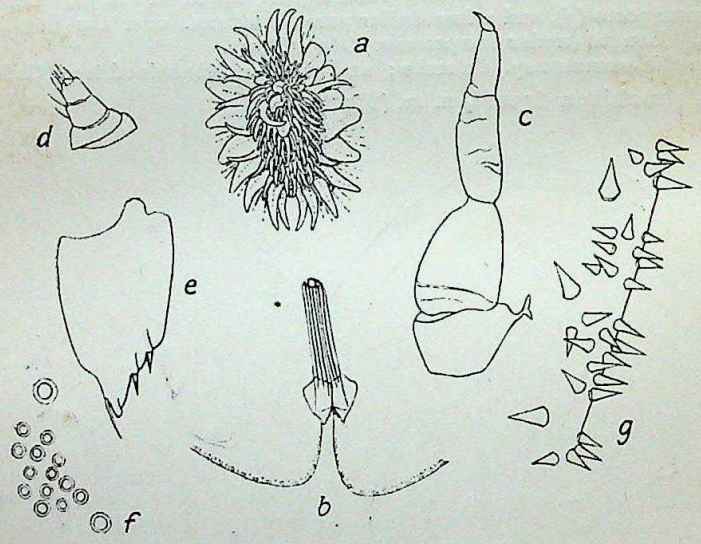

FIG. 34.—*Ctenochiton olivaceum.* (*a*) Adult ♀, dorsal view, × 4 (*b*) Posterior extremity, × 30. (*c*) Anterior leg, × 220. (*d*) Antenna, × 220. (*e*) Left valve of anal operculum, × 130. (*f*) Sockets of marginal spines, × 220. (*g*) Marginal spines, × 220.

Adult female (*a*) with the dorsum completely covered with a confused mass of slender, translucent, waxy processes, most of which are directed backwards. There are three or four stouter, bluntly conical processes on the medio-thoracic area. Margin with a series of larger, tapering, broader and flatter processes interspersed with a few delicate, silky filaments. When placed in boiling potash the whole of this covering comes away, complete in one piece. Colour of secretionary covering olivaceous green, darker on the median area. The sublying insect is of a pale castaneous tint. Antennæ (*d*) small and rudimentary, consisting of three or four confused joints. My single example has lost all but one anterior leg (*e*) which is small and wrinkled: femur unusually short, with the trochanter much compressed; tarsus about two-thirds as long as the tibia. The

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digitules are missing (probably broken off). Anal ring with six very long setæ which are contained in an unusually long anal tube (*b*). Valves of anal operculum of irregular form (*e*), the extremity produced; two short spines on the apical half of the inner margin and a longish, stout seta immediately outside the apical point. Margin (*g*) with numerous stout, sharply pointed, conical spines arranged in small clusters with a single larger spine in each interval. The arrangement and relative proportions of these spines can be seen more clearly on areas where they have been displaced, leaving their sockets (*f*) exposed. No stigmatic clefts or specialized stigmatic spines. Overall dimensions 7 by 5 mm. Length of denuded insect 4·5 mm.

Described from a single example, on the undersurface of a leaf of Pterospermum suberifolium : Matale.

Inglisia chelonioides, Green. (Fig. 35.)

Coccidæ of Ceylon, Vol. iv, p. 283 (1909).

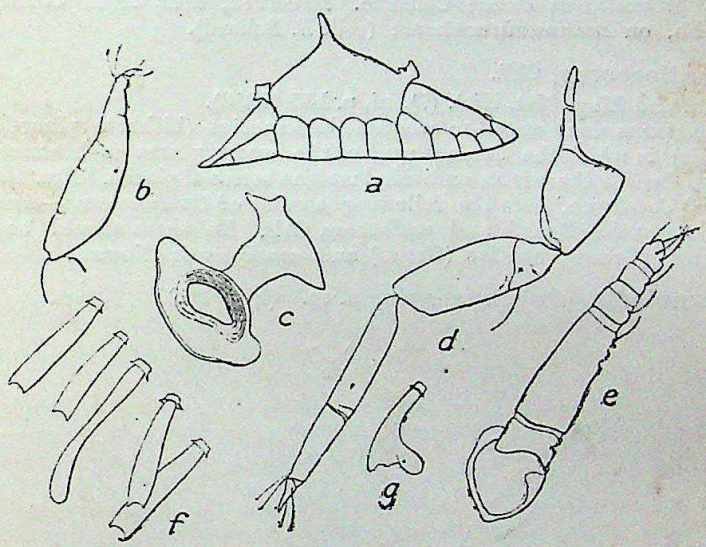

FIG. 35.—*Inglisia chelonioides*. (*a*) Adult ♀, after treatment with potash, × 6. (*b*) Tibio-tarsal joint of mid leg, × 220. (*c*) Posterior spiracle, × 220. (*d*) Hind leg, × 220. (*e*) Antenna, × 220. (*f*) Marginal and stigmatic spines, × 450. (*g*) Aberrant form of stigmatic spine, × 450.

At the time of publication (loc. cit.) I was in possession of a single example only, which I was reluctant to destroy. I was able, therefore, to describe the external characters alone. I have, since then, obtained further material, both from Ceylon and from India, from which the following details have now been drawn up.

The denuded insect (*a*), after being boiled in potash, is of the form indicated on Plate CVII (of my Monograph). fig. 3, which shows a diagrammatic view of the area occupied by the body of the insect. The derm of the dorsum is densely chitinous ; that of the venter very thin and delicate. At the centre of the dorsum is a prominent erect, horn-like process. At about midway between this and the anterior extremity is a smaller, irregularly tricuspid prominence ; and, at about the same distance from the posterior extremity, is a similar process. The position of the waxy plates

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of the living insect is sharply defined by densely chitinized infoldings of the derm. The antennæ (*e*) are 6-jointed; the 3rd elongated, almost equalling the total length of the remaining five joints; terminal joint short. Limbs relatively small and weakly chitinized: on the anterior and mid legs (*b*) the tibio-tarsal division is obscure or incomplete; on the third leg (*d*) the division is distinct, the tarsus being approximately three-quarters the length of the tibia. Ungual and tarsal digitules slender, the former slightly dilated towards the extremity, the latter minutely knobbed. Spiracles (*c*) large and conspicuous, rather densely chitinous. Anal operculum very narrow, twice as long as it is broad; each valve four times as long as the breadth, the base very short, the outer and inner margins of approximately equal length. Margin of body with a close series of flattened, ligulate spines (*f*), with concave extremities. Opposite each spiracle is a single longer, cylindrical (*f*) or irregularly expanded (*g*) stigmatic spine. Lateral areas with many small, inconspicuous, rounded dermal cells. Length 7 to 7·5 mm.

On *Pithecolobium dulce*: Colombo. Received, also, from Coimbatore, S. India, on *Parkinsonia aculeata*; (coll. E. Ballard).

Cardiococcus; Ckll.

Ann. and Mag. Nat. Hist. (7), xi, p. 155 (1903).

This genus was erected to accommodate species (hitherto placed under *Inglisia*) in which the arrangement of the waxy plates is bilateral. In typical *Inglisia* there is an undivided median series of plates. Mrs. Fernald, in her 'Catalogue,' lists the following species of *Cardiococcus*:—*forminifer* (Mask.), *fossilis* (Mask.) and *umbonatus*, Ckll. To these should be added *bivalvata* (Green), *castilloæ* (Green) and *cenehiformis* (Newst).

Lecaniodiaspis mimusopis; n. sp. (Fig. 36.)

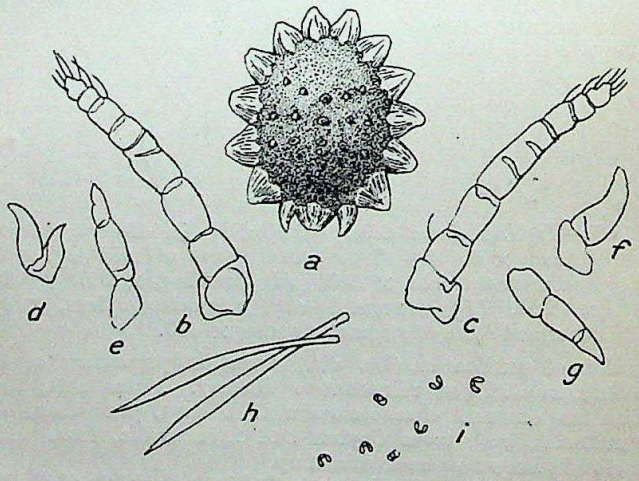

FIG. 36.—*Lecaniodiaspis mimusopis*. (*a*) Adult ♀, dorsal view, × 3. (*b*, *c*) Antannæ, × 130. (*d*, *e*) Anterior legs, × 130. (*f*) Mid leg, × 130. (*g*) Hind leg, × 130. (*h*) Setæ from anal ring, × 220. (*i*) Paired pores, × 450.

Test of adult female (*a*) approximately circular; strongly convex. Colour dull pale brown. Surface so minutely granular as to appear

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smooth. Margin with a continuous series of broad, flattened, triangular, whitish, waxy processes which (in the example under examination) number 15, the hindermost one being medially disposed, the remainder paired. Across the middle of the dorsum are three transverse series of five small, whitish, truncately conical, waxy points and, behind these, a short medio-longitudinal series of three similar points. Overall diameter of test 9·5 mm.

The structural characters of the insect itself were obtained from a single example, in poor condition, and are consequently incomplete. The two antennæ (*b*, *c*.) are not symmetrical. In one (*b*) there are eight distinct joints and an incomplete division in the 4th. In the other (*c*) there are only 7 distinct joints, but the long 4th joint shows two incomplete divisions. In each case, if all the divisions were complete, there would be nine joints. The two terminal joints are very short. The legs are more or less rudimentary, but vary in the amount of their development. Of the first pair, one (*e*) shows complete division between the femur and tibia ; while the other (*d*) consists of two joints only, a coxa and a fused terminal joint. This condition is repeated in the mid legs (*f*); but the hind limbs are distinctly 3-jointed (*g*). The spiracles are large and conspicuous. The anal aperture is supported by the usual bilobed chitinous plates. Anal ring with 8 stout, lanceolate setæ (*h*). The cribriform plates are small and irregular in form ; but, owing to the poor condition of the material, their exact position and number cannot be determined. For the same reason I have been unable to locate any stigmatic spines. Derm closely studded with minute V-shaped or bilobed pores (*i*) and crowded with the usual tubular glands.

Described from two examples only, on the bark of *Mimusops hexandra* ; Hambantota. This is, by far, the largest known species of the genus. Judged by external characters alone, the insect might be mistaken for a species of *Walkeriana*.

Asterolecanium gutta, n. sp. (Fig. 37.)

Test of adult female bright yellow, translucent, highly polished. The reddish ova, showing through the test, give it a maculate appearance. The shrivelled body of the insect is revealed as a deep brown patch at the anterior extremity. There is a fragmentary and rather inconspicuous fringe of pinkish filaments. Form of test approximately circular and hemispherical. Average diameter 3 mm.

The actual insect (*a*) is broadly pyriform, narrower behind, the anal segment slightly produced but without prominent anal lobes. There is a conspicuous, uninterrupted, marginal series of

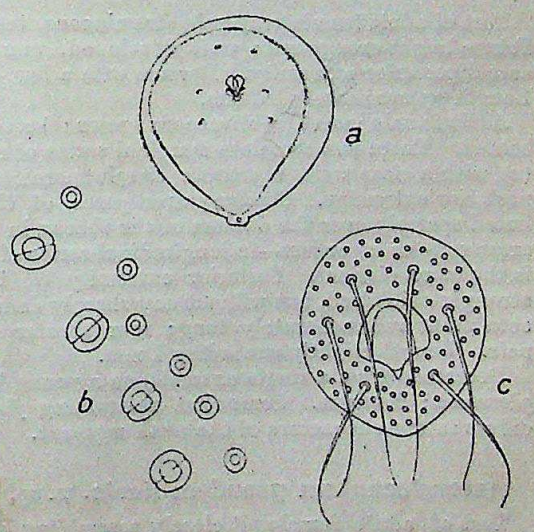

FIG. 37—*Asterolecanium gutta*. (*a*) Adult ♀ ventral aspect, × 13. (*b*) Marginal pores, × 450. (*c*) Anal ring, × 450

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paired and simple pores (*b*), both of which are unusually large. In places, particularly on the frontal area, the series tends to be irregularly double. There are no supplementary paired pores on the dorsum. The two halves of each pair are oblate and closely applied to each other, without any interval. Both paired and simple pores have thickened rims. Anal ring (*c*) broad and densely chitinous, closely studded with small circular pores, and bearing six stout setæ. Length 2 mm.

On young branches of *Calophyllum walkeri*: Pattipola. The yellow tests resemble small congealed drops of gamboge gum.

Asterolecanium loranthi, n. sp. (Fig. 38.)

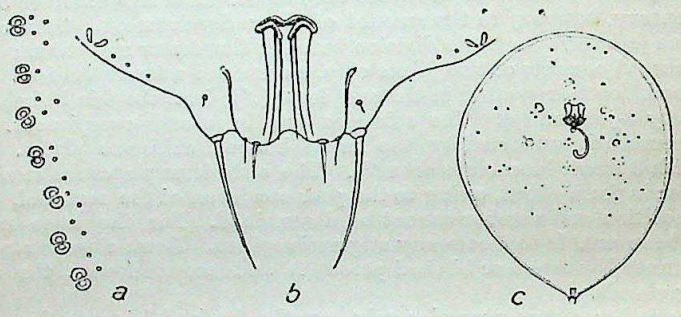

FIG. 38—*Asterolecanium loranthi*. (*a*) Marginal pores, × 450. (*a*) Posterior extremity of adult ♀, × 450. (*c*) Adult ♀, ventral aspect × 30.

Test of adult female very pale stramineous, translucent, broadly ovate. Fringe bright orange-red; well developed, uninterrupted except at the actual posterior extremity. Dorsum with a few, scattered erect filaments. Length approximately 1·5 mm.

Adult female insect (*c*) olivaceous brown; broadly ovate, bluntly pointed behind. There is a complete marginal series of rather small paired pores (*a*), with a close series of minute simple pores, extending almost to the posterior extremity. Similar paired pores, of the same size, are distributed sparsely over the dorsum of the thorax in small, ill-defined groups, arranged—more or less—in longitudinal series of which the median series is the more distinct. Posterior extremity (*b*) indistinctly lobed; rather strongly chitinized, but without any sharply defined dorsal plates. Caudal setæ stout and moderately long; four shorter setæ between the caudal pair. Length slightly exceeding 1 mm.

Described from a single example, on a young branch of *Loranthus neelgherrensis*: Hakgala. Somewhat resembling *flavocilliatum*, from which it differs in the characters of the anal segment.

Asterolecanium pseudomiliaris. n. sp. (Fig. 39.)

Test of adult female (*d*) closely resembling that of *miliaris*; but more delicate in texture and more irregular in outline. Very pale yellow, translucent; early adult examples with a median reddish line. Posterior extremity narrowed and tapering to a blunt point; with a low, rounded,

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median carina. There are three longitudinal series of very slender and delicate colourless, glassy, double filaments on the dorsum. Marginal fringe colourless or slightly tinged with pink; irregular, usually incomplete, moderately long. Length 0·75 to 1·25 mm. Breadth across median area 0·4 to 0·5 mm.

Adult female insect (*b*) pale yellow; often deeply and irregularly indented on the cephalo-thoracic margins. Posterior extremity (*c*) rounded. Caudal setæ stout, crossed, set on small but distinct anal lobes. Anal ring with six setæ. There is a narrow, transverse, dorsal plate below the anal ring. Marginal paired pores (*a*) very small, distant from each other by more than their own length; continuous to within a short distance of the posterior extremity. Ventral simple pores few, minute, at a considerable distance from the margin. Some larger paired pores occur on the dorsum, arranged in three longitudinal series, about ten in each series. Length 0·4 to 0·6 mm.

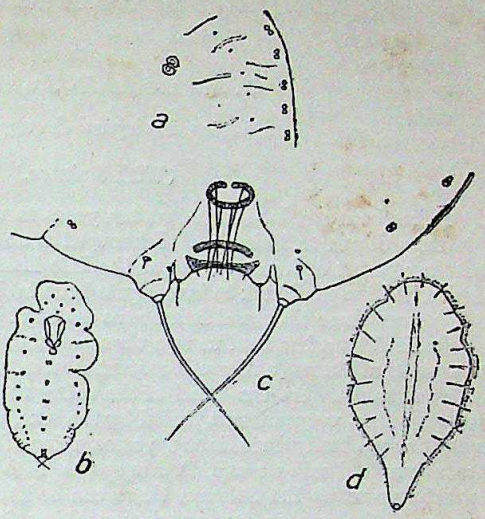

FIG. 39—*Asterolecanium pseudomiliaris*. (*a*) Marginal and discal pores, × 450. (*b*) Adult ♀, × 50. (*c*) Posterior-extremity of adult ♀, ×. 450. (*d*) Test of adult ♀, × 30.

On foliage of *Bambusa* sp. Peradeniya.

Differs from *miliaris* in the presence of erect filaments on the test, and of supplementary paired pores on the dorsum of the insect.

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FISH AND FISHING IN THE INLE LAKE.

BY

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Director, Zoological Survey of India.

(With 3 plates.)

It has been my lot in the last ten years to visit many lakes, scattered over Asia from Japan to Palestine. I know of none so interesting to the naturalist and the student of human races as the Inle Lake in the Southern Shan States, which I had the good luck to investigate both in 1917 and in 1922. It lies in a hollow some three thousand feet above sea-level but bordered on either side by mountains fifteen hundred to two thousand feet higher. As in hilly country in other parts of Burma and south-eastern Assam, these mountains run almost due north and south. At the head of the valley there is an alluvial plain, evidently covered at no very distant period by the lake, while to the south the bordering mountains gradually dwindle and a stream flows down to Karen-ni, where, more than a hundred miles away, it disappears into the ground. That its water ultimately reaches the Salween there can be little doubt. The area of the lake varies with the seasons, but, roughly speaking, it is fourteen miles long, about four miles broad and of an irregular oval shape.

In the physiography of the lake two features are particularly striking, the clearness of the water and the floating islands that form a ring round the margin. Both these features give a peculiar beauty, unique in my experience, to the Inle Lake. The Loktak Lake in Manipur has the floating islands, less rich and less varied in vegetation but formed in the same way and of the same general appearance, but its waters are muddy and turbid.

Out in the middle of the lake, a mile and a half from any land, the State of Yawngwhe maintains a bungalow for the use of visitors, supported on strong wooden posts and stoutly constructed of bamboo matting with wooden floors and beams and a thatched roof. Around and under this ideal retreat one can watch the fish and the beautiful and highly peculiar water-snails almost as in an aquarium, except that the point of view, natural to an air-breathing animal, is from above. In the mornings of early spring the surface is usually unruffled by the slightest breeze, the water is as clear as glass and the luxuriant growth of the submerged weed (*Najas minor*) provides a background and a floor unrivalled in graceful outlines and the beauty of its deep greens and browns. The house-posts themselves are veiled in a thin film of fixed vegetable and animal life, mostly in delicate tones of rusty tint.

Round and round the house swims the Inle Herring Barbel (*Barbus compressiformis*)* , a graceful green-backed silvery fish only known from the Inle Lake. The smaller fish congregate in shoals and rush to the surface, some little distance beneath which they usually swim, when anything edible or otherwise is thrown into the water. If it be edible they await its descent for a few inches before attacking it. Everything that it is not too hard or too big they find edible, and they are very foul feeders. The larger fish of the same species, half a pound or rather more in weight, remain near the bottom and swim solitary. They are not attracted by what happens on the surface. From their large mouths and from their general structure and appearance, not

* The species was originally called *B. compressus* by Boulenger (*Ann. Mag Nat. Hist.* (6) XII. p. 202, 1893) and the name was changed at the suggestion of the author to *B. steadmanensis* in 1918 (*Rec. Ind. Mus.* Vol. XIV, p. 47) In the meanwhile, however, Cockerell had called it *B. compressiformis* in a paper on the scales of fishes (*Bull. Bour. Fisher.* (Washington) XXXII, p. 133. 1913).

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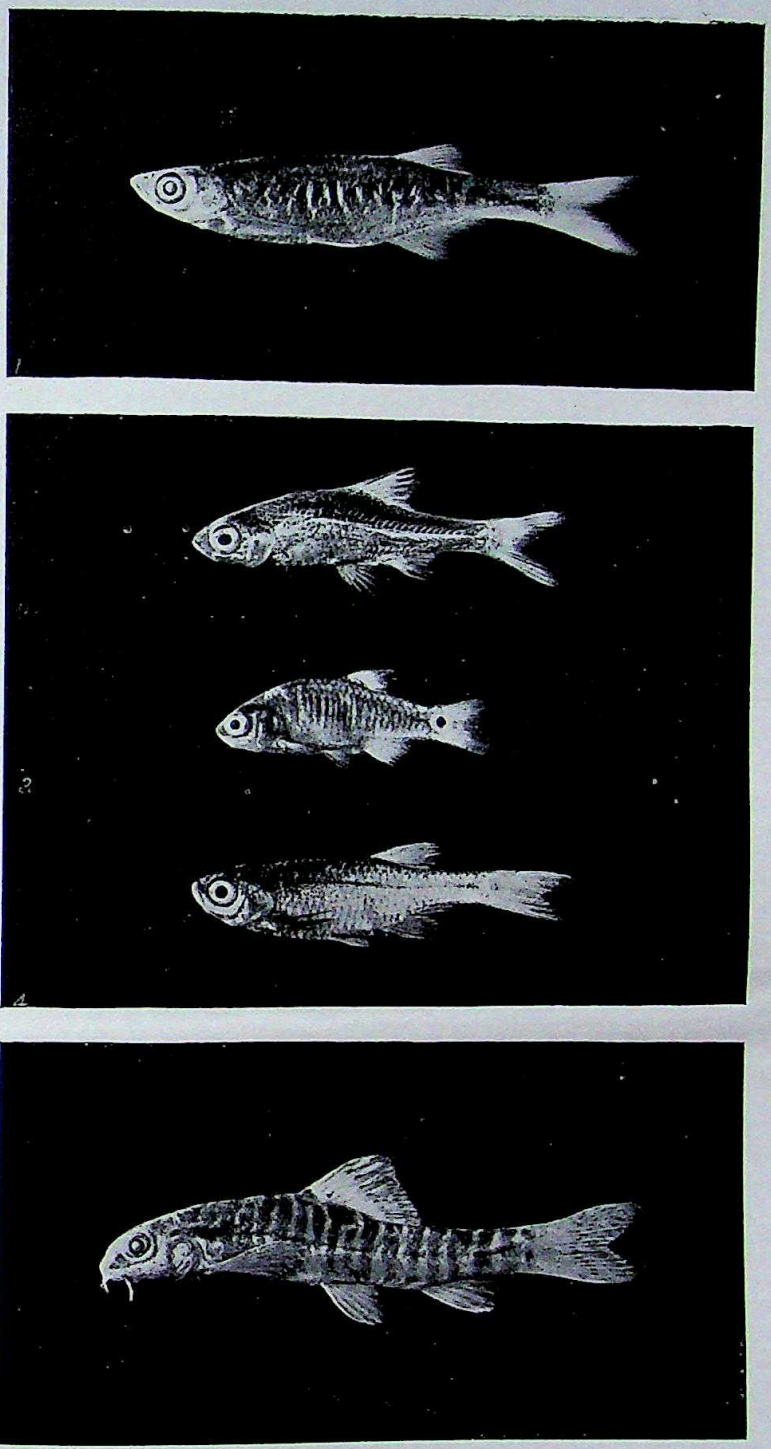

Characteristic Fish of the Inle Lake.

Fig. 1.—The Golden Sprat Barbel (*Barileus auropurpureus*, Annand). Slightly reduced.

Fig. 2.—The Scaleless Minnowlet (*Sawbwa resplendens*, Annand). Twice natural size.

Fig. 3.—The Crimson Minnowlet (*Microrasbora erythromicron*, Annand). Twice natural size.

Fig. 4.—The Red-headed Minnowlet (*Microrasbora rubescens*, Annand). Twice natural size.

Fig. 5.—Browne's Loach (*Nemachielus brunneanus*, Annand). Twice natural size.

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unlike that of small pike, they are probably both predaceous and voracious. Here and there single individuals of the Burmese Red-Finned Barbel (*Barbus sarana caudimarginatus*) may be seen, but apart from the Herring Barbel. With the young Herring Barbel, but not mixing with them, are still larger shoals of a smaller but more beautiful fish. Like the Assyrian host, its "cohorts are gleaming with purple and gold." Its sides are golden, its belly silver, and on its sides are numerous bands of deep purple-blue. This fish is unknown outside the Inle Lake-system. To it has been granted the name *Barilius auro-purpureus*. Its shoals have the habit of conglomerating from time to time into great spheres of living units a short distance below the surface. More of a surface fish than the Herring Barbel, the Golden Sprat Barbel, (as it may be called familiarly), feeds mainly on the small may-flies and caddis-flies and gnats (fortunately not mosquitoes) that rise from the lake in countless thousands every evening. It does not, however, ignore the attraction of the kitchen perched above its abode. In the heat of the day it goes to the bottom and may there be seen through the glassy water, eight feet down, tugging worms and insect-larvæ from the mud, a task for which its upwardly directed mouth is ill-adapted. It has to lie well over on its side to get a grip and often turns completely upside down in its struggles.

In the weeds skulks the Small Burmese Murrel (*Ophiocephalus harcourt butleri*), a voracious fish, and occasionally a Shan Carp (*Cyprinus carpio intha*), a fish which lives by "suction" from the mud of the bottom. In the He-Ho plain, which lies to the east of the Inle Lake and eight hundred feet higher but belongs to the same lake-system, the Carp (*Cyprinus carpio*) apparently reaches the western limits of its range in southern Asia. It is on the Shan plateau from He-Ho eastwards that the local race (*intha*) has become differentiated. In the weeds also live shoals of two other fish, both smaller than the English Minnow, both confined to the lake and its connected waters, both of gorgeous colouration and both belonging to small genera of limited range. Both are highly peculiar representatives of the carp family and both are remarkable not only for their small size and brilliant tints but also for their large eyes. This last feature is characteristic of the fish-fauna of the lake, in the clear water of which barbels and other tactile organs are rarely well-developed, while full advantage is taken of the high visibility in the strong development of organs of vision. The two little fish have been called *Sawbwa resplendens* and *Microrasbora rubescens*. We may refer to them here as the Naked Minnowlet and the Red-headed Minnowlet. The former is unique in the carp family in that it has completely lost its scales. In the male the sides of the body are of an intense steely blue, while the head and the unpaired fins are of the most brilliant scarlet. The female, though more moderately garbed has a fine silvery sheen. The Red-headed Minnowlet possesses scales and is less abnormal in other respects. In both sexes the sides and lower parts of the head are orange-scarlet, while in the breeding male the whole body is suffused with the same bright hue. Neither of these fishes ever grow much more than an inch long.

Yet another little fish, even more abnormal than either of the Minnowlets, is also to be found, single and not in shoals, among the weeds under the bungalow, namely *Chaudhuria caudata*—a species so peculiar that it has been found necessary to propose a new family for its recognition. It is a little eel-like, or rather worm-like, creature, which does not grow much more than two and a half inches long. Small size, as well as large eyes and bright colours (neither of which *Chaudhuria* possesses), is characteristic generally of the fish of the lake.

Of the fish that live under and around the lake bungalow, I have left to the last the one that is most peculiar in habits. To it the Intha or "Sons of the Lake" have given a name which means the "fish that climbs the posts of houses". Its scientific name is *Discognathus* (or *Garra*) *gravelyi*. Both its Intha name and the generic name by which it is most generally known refer to obvious physical or

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physiological peculiarities. Its mouth is situated on the lower surface of the head and immediately behind the mouth there is a large flattened disk by means of which it can adhere to any solid object. Most of the species of the genus*, which are numerous in the hilly districts of India and Burma, inhabit rapid-running water and cling by means of their disk to rocks or stones in the current. Such a habitat does not afford the same facilities for watching the mode of life as does the lake-bungalow. One usually sees the fish swimming out in a clumsy manner from a mass of weeds, moving forward by abrupt and awkward jerks of its tail. It swims to one of the house-posts, to which it affixes itself by means of its disk. It spreads out both its paired fins flat against the post like a couple of fans on each side of its body. With its sharp upper jaw it then scrapes from the post the minute algæ and Polyzoa which cover the wood. These are prevented from escaping by the deep fold of skin that forms a false upper lip, and are swallowed as they are set free. As it feeds the fish moves gradually up the post, thrusting itself upward by hardly perceptible movements of its tail.

These are the fish most abundant beneath the bungalow; but others are also to be seen occasionally: for instance, the two stickle-back eels (*Mastacembelus caudiocellatus* and *M. oatesii*) peculiar to the Inle Lake system. Mr. Tate Regan† of the British Museum believes that it is to their family, or at any rate sub-order, *Chaudhuria* belongs, and doubtless he is right at any rate as to the sub-order. But as the most salient characters of the Stickle-back Eels are the spines on their backs and their peculiar fleshy snouts, neither of which characters *Chaudhuria* possesses, it is a remarkably isolated little fish.

I have mentioned twelve different kinds of fish as living beneath the Lake Bungalow, but this by no means exhausts the fish-fauna of the lake, from which no less than thirty-five or thirty-six species have been recorded. Of these, three are mud-loving forms of wide distribution in Eastern Asia, but found in the lake only among the floating islands at the edge. They are the two amphibious eels *Monopterus albus* and *Amphipnous cuchia* and the Black Cat fish *Clarias batrachus*. The last is regarded as one of the best edible fish in the lake, but is a foul feeder and the flesh is too soft to my taste. The Shans will not eat the eels, the flesh of which they believe to produce leprosy, probably on account of the livid mottled colour of their skins. The Intha, or true Sons of the Lake, have no such prejudice.

Among the islands at the edge, but near the surface under floating grass and water-weeds, a very different fish is found. It is even smaller than the two little fish that live amongst the thickets under the bungalow, hardly attaining the length of half an inch, but still more gorgeous in colouration. Its ground-colour, so to speak, is deep crimson and it bears on its sides a series of deep blue bars. At the base of its tail there is a large round eye-like black spot surrounded by a pale ring. The name of this fish is *Microrasbora erythromicron*. It is probably the smallest of the whole of the great carp family. For a trivial name I would suggest that of the Crimson Minnowlet.

The other species in the fish-fauna call for no very special notice, though several of them are peculiar to the lake. They belong to the carp family in a wide sense with the exception of the wide-ranging Freshwater Herring (*Notopterus notopterus*) and Striped Murrel (*Ophiocephalus striatus*), but three of them are small loaches of the family Cobitidae in a restricted sense. Further particulars may be found in my paper in Vol. XIV of the *Records of the Indian Museum*.

The method of fishing used in the Inle Lake are almost as diverse as the species of fish. The most striking to the visitor who is there in March are the use of floating islands as decoys for fish, and the manœuvres of the spearing parties, to be seen daily on the lake especially on the day before one of the local markets.

* See Hora, *Rec. Ind. Mus.* XXII, pp. 633–687, pls. xxiv–xxvi (1921).
† Regan. *Ann. Mag. Nat. Hist.* (9) III, p. 198, (1919).

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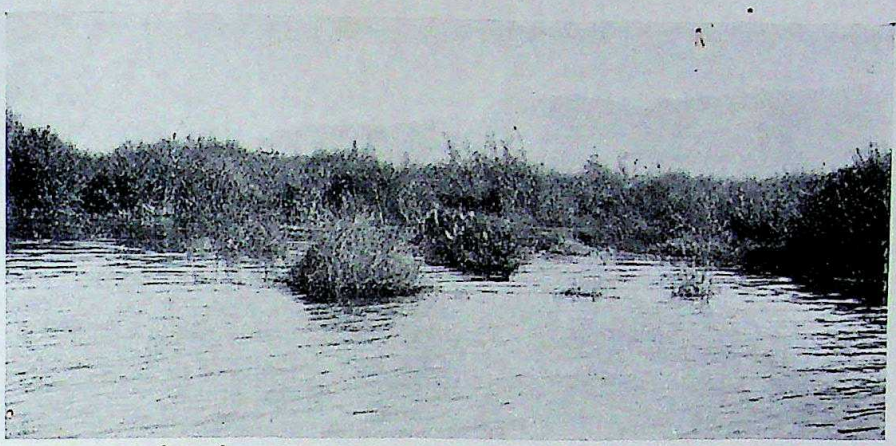

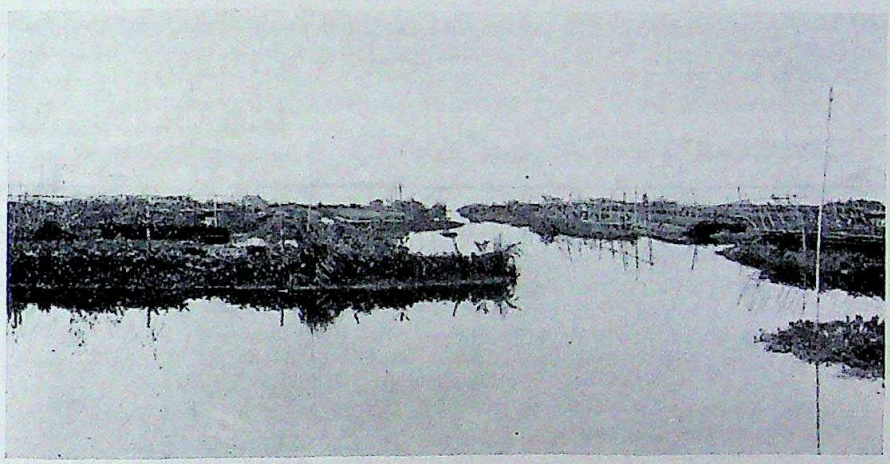

Floating Islands of the Inle Lake.

FIG. 1.—The islands in their natural state (above).
FIG. 2.—Islands used as gardens (in the middle).
FIG. 3.—In the floating village of Ka-le (below).

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The floating islands, as already stated, surround the lake in a ring. They are formed entirely of growing and decaying vegetation. The first stage in their formation is the growing out, either from the shore or from an already formed island, of long shoots of various grasses and sedges which float on the surface. Among these shoots floating water-plants, such as the water-lettuce, duckweed, etc., get entangled and also much vegetable debris, including the topmost branches of the submerged plant *Najas* which are killed as the water sinks in the dry season, partly by dessication, partly by the heat of the sun, and partly by the luxuriant growth of algæ of the family Rivulareaceæ encouraged by this heat. Other shoots of similar plants and the floating masses of other weeds such as *Ammania rotundifolia* also get entangled. The peculiar chemical composition of the water transforms the dead parts of all this vegetation into a kind of peat, which soon forms a fertile soil held together on the surface by the roots of the growing plants. A rich flora springs up on this soil, including both ferns and numerous flowering plants such as orchids of two species and a peculiar *Utricularia* with yellow and purple flowers. This plant produces its flowers on long trailing stems which twist up the reeds to a height of several feet. A large shrub (*Cephalanthus occidentalis*) also grows on the floating islands and in places forms regular thickets amongst the tall grasses and sedges.

The floating islands are of primary importance in the economy of the Intha. Pieces of them can be cut off with iron spades and towed to any convenient spot. They are used for a great variety of purposes; as cemeteries it is said, and certainly for horticulture, in fisheries, and as break-waters to protect houses built out on the lake. Our concern here is with them as fishing appliances. Any fisherman can, without cost to himself, cut off an island of suitable size, tie it to his boat by means of the reeds growing upon it and ropes made by twisting these reeds together, and tow it away anywhere on the lake; or if he is too occupied or too unskilled himself, he can hire somebody else to do all this for him, paying according to a recognized tariff based on the size of the island detached. Towards the latter end of March the process may be watched daily. A long strip of island, commonly of a hundred feet in length and five or six feet in width, is first cut off and tied to a boat, which is fastened at the side towards one end. The boatman, who is sometimes quite a small boy, laboriously poles the mass along until he reaches the appointed site. The island is then manœuvred until its long axis points directly across the lake and is fixed in this position by means of numerous long bamboo poles thrust through it down into the water and into the soft mud of the bottom. All of this is usually a day's work and sometimes the island-cutter—a recognised profession amongst the Intha—has to anchor his island temporarily for the night before he reaches its halting-place. Once in position he proceeds to cut off from one end of the island a piece about as long as broad. This he releases by pulling out the pole, or poles, thrust through it and tows it away to some distance in a straight line with the main piece. When he has towed it far enough he anchors it again with the pole and cuts off another piece of the same size, which he treats in the same way. The division and the towing-out of fragments of the original strip continues until there is a regular line of little islets extending out across the lake at regular intervals for a distance of several hundred yards.

Each of these islands is a trap, or rather a decoy, for fish. The main breeding-season in the lake begins just about the time that the islets are floated out and for most freshwater fish in tropical Asia the one essential at sprawning time is cover and a suitable nidus. For these reasons the fish are attracted to the shade of the islets and are there caught at night by means of dip-nets and various other kinds of nets.

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An even more peculiar method of fishing is the use of the spear, either alone or in company, either by day or by night. The Intha fish-spear is of two kinds. One has two prongs of iron, each with a single barb on its inner side. The two prongs are inserted in a mass of resin at the end of a bamboo. This kind of spear is only used for catching eels in the mud. The more popular kind has five similar, but finer, prongs cast in one piece with a corkscrew spike at the base. This spike is inserted into the stem of a long reed and neatly bound in position. The spear is used for catching all kinds of fish, especially the true Carp, which is the most abundant fish in the Intha markets, and the Herring Barbel. The spear is always used from a boat, and the Intha are extremely skilful in its manipulation.

Their boats are long and narrow, bifurcate and slightly turned up at either end. They are formed of stout planks of wood neatly fitted together and covered with black varnish in such a way as to give the impression of being carved out of a single log. They are flat-bottomed but very easily worked, answering to the slightest turn of the paddle. The Intha have a peculiar method of rowing by means of which they are said, in their own boats, to excel all other Burmese rowers in speed. They are "leg-rowers": that is to say, they row standing with one leg twisted round the paddle and use the leg in working, the oar as well as one arm. They can actually row in this way with one arm and one leg, standing on the other leg, and spear fish with the other arm. In this extraordinary manœuvre they seem to be quite ambidextrous as well as being able to use either leg indiscriminately.

In the use of the spear they are equally ambidextrous. Often a man or a boy goes out to spear fish alone. In order to prevent the boat turning round in an inconvenient manner while he is executing the manœuvre already described he hangs over the end of the boat that happens to be hindermost at the time—for the two ends are alike—a piece of rope to either end of which a small flat plank is attached. The string is just long enough to allow the two planks to hang in the water. They are very efficient in giving the boat stability. Sometimes the fish-spearer trusts merely to his own skill. He stirs up the weeds with a long bamboo pole and spears the fish as they come out, or waits for them over a clear space in the submerged thickets. Often he uses a large conical structure made of reeds sufficiently long to reach the bottom of the lake. This he inserts over a likely mass of weeds or at a place where he has seen a fish take shelter. In the narrow end of the cone, which remains uppermost, there is a small hole and through this hole he jabs down his spear until he hits the fish or decides that he has not succeeded in enclosing one.

Frequently a number of men combine together in spearing parties. They surround a suitable weedy area with a net the lower end of which is weighted and rests on the bottom while the upper end, to which floats are attached, lies some little distance below the surface of the water. The fishermen in their canoes remain inside the space enclosed by the net and alternately hit the surface with their paddles to frighten the fish and thrust at any they see. They know that the natural tendency of those fish which haunt the submerged thickets is to dive downwards and that individuals which escape their spears will swim along or near the bottom and entangle themselves in the net instead of making their way over the top. The fish caught most commonly in this way is the Herring Barbel, while the one particularly sought with the aid of the cone of reeds is the true Carp.

The most profitable method of spearing, however, is to go out at night with a small fire or a lamp at the front end of the boat which both attracts the fish and lights up the water. Sometimes single boats go out for the purpose, at others several advance together in a line. For every method of fishing the fisherman has to pay a small monthly license to the State. That for spearing at night with a light is the most expensive of all, costing Re. 1 a month.

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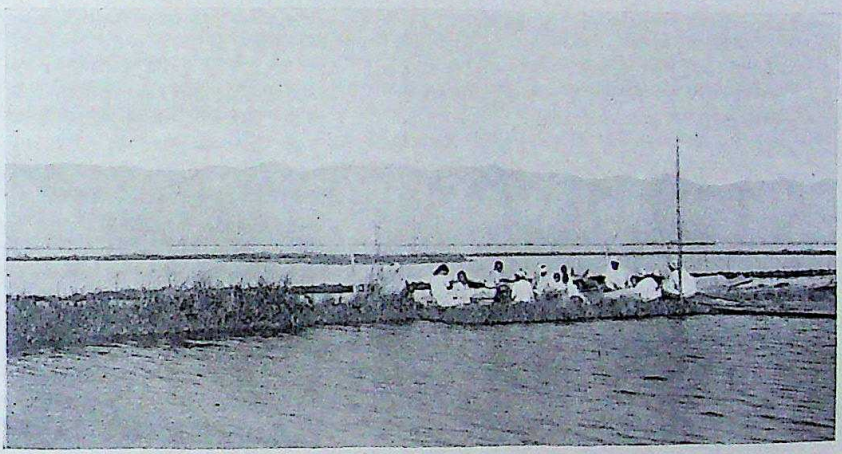

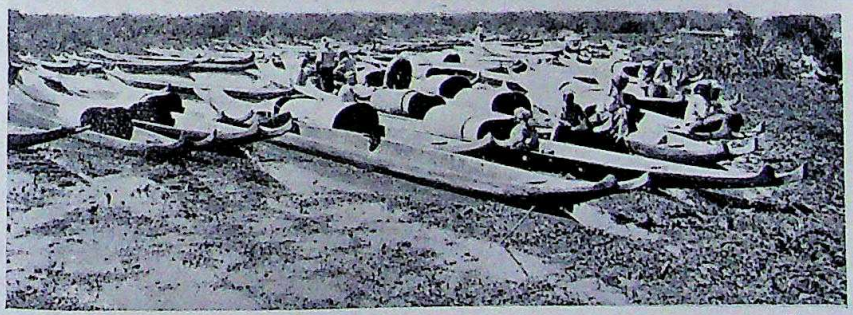

Boating and Fishing on the Inle Lake.

Fig. 1.—Inthas leg-rowing (above).
Fig. 2.—Inthas making a fishing enclosure for the capture of *Crossocheilsu latia* (in the middle).
Fig. 3.—Boats at the edge of the Lake on market day (below).

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Numerous other methods of fishing are also adopted and most of the different kinds of nets and traps in common use throughout the Indian Empire are known to the Intha. I shall only mention two more methods which seem to me to be characteristic. The first is that of making large enclosures for the special capture of the fish *Crossocheilus latia*, a species usually found in running water, but not uncommon in the lake. The enclosure, which often surrounds a very large area, is made of masses of water-weed (*Najas*) dried and pegged down with bamboo poles to form a surrounding wall in the water and reaching up to the surface. Conical traps made of weeds are fixed in this wall. The fishermen take their boats into the enclosure and paddle about, striking the water with their paddles and stirring up the weeds with bamboo poles. At the end of the enclosure towards which the boats move, nets are fixed up in the air on poles to a considerable height. As the fish are driven out from the weeds many of them make their way into the traps, while others, attempting to jump over the wall, land themselves in the aerial nets.

The last method of fishing that I shall attempt to describe is the use of what may be called the weed-trawl. This is a bag-shaped net fixed in a bamboo frame with an almost triangular outline but with the top rounded instead of pointed. The broader end is strengthened by a bamboo running across the side-pieces. Two boats and three men are necessary for the use of this net. The two boats remain at first a few yards apart. In one of them there is a single fisherman; in the other, two. The single fisherman plunges the trawl downwards into the water among the weeds, holding it by the upper end. The two men in the other boat then pull it towards them by means of a couple of ropes fixed to the sides near the lower end. They thus pull up the lower end obliquely through the weeds capturing numerous stickle-back eels, carp and other fish in the mass of vegetation they detach.

The Intha are versatile folk. They are not only fishermen and agriculturists but also keen traders and skilled weavers of silk and cotton. Perhaps their most characteristic means of livelihood is the trade they conduct in dried whitebait and dried prawns. In both cases the animals which compose the product are of extremely small size. The fish belong mostly to such genera as *Sawbwa*, *Microrasbora*, *Nemachilus* and *Lepidocephalus*. In other words they are fish which never attain the length of more than a few inches. Some years ago it was proposed to suppress the industry as being destructive to immature fish. After careful examination of samples from several of the Intha bazaars I was able to assure the authorities that in none of these samples was the proportion of fish capable of growing to a reasonable size more than 5 per cent. and that in a very large proportion such fish were completely absent. The trade was not suppressed, and the product is still carried by coolies and on pack-oxen and mules as far as the Siamese frontier over three hundred miles away and up through the He-Ho gorge (by coolies only) to the railhead at He-Ho.

The dried prawns, which are not mixed with the fish in the bazaars, consist of two species of the genus *Caridina* * and are even smaller than the fish. Both fish and prawns are dried in the sun on mats. They have no bad smell when of good quality and form a palatable condiment for curry when fried with onions and salt and pepper.

The Intha claim to be Burmese not Shans and to have come at some not very remote period from Tavoy. Authorities say that this legendary origin is confirmed by their language, which is a dialect of Burmese akin to Talaung. They dress like the Shans however, the men in baggy trousers and a short jacket and a loose turban, the women with a long simple skirt in place of the trousers, but also with the turban. They are sturdily built and taller than the Burmese properly so-called. Their faces are broader, their features generally of coarser

(*) Kemp, *Rec. Ind. Mus.* XIV, p. 96 (1918).

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type. Their houses are like those of the Shans but are often built on bamboo poles in the water.

As in other parts of Burma a bazaar is held in each village once every five days. No two villages within easy walking distance have the same market day, but in any one small district there is a market that any one can attend somewhere practically every day of the week. The biggest market in the State of Yawnghwe is held at a large village called Nan-pan, which is situated just south of the lake on the river that runs down to Karen-ni. Two thousand boats are said to come to this market on a full market as well as numerous pack-oxen from the eastern part of the State, while the hill tribes for many miles round come down on foot.

The people of Nan-pan are famous for their silks, for their iron-work, their gongs and their lacquer tables. Their blacksmiths are said to be the most skilled in the country and provide a great deal of the gilded iron foliage with which the thrones of the images of Buddha in the temples of Yawnghwe are decorated. A few men in this village are still able to make the fine boxes in niello work in which Intha elegants carry the lime for their betel-chewing. Very beautiful little tables, or rather low stands for holding food-dishes, are here made of bamboo basket-work covered with red and black lacquer on a wooden stand. They are used particularly by the monks and numbers of them are to be seen in any of the numerous monasteries that stud the shores of the lake.

But, in spite of all these industries and arts, the Intha are essentially simple fisher-folk, and it is to the lake and its fauna they owe the fact that they are in a position to indulge in such luxuries as silk trousers and lacquer tables. Even their fishing-nets are sometimes made of silk through the crude material is brought overland from China many hundred miles away.

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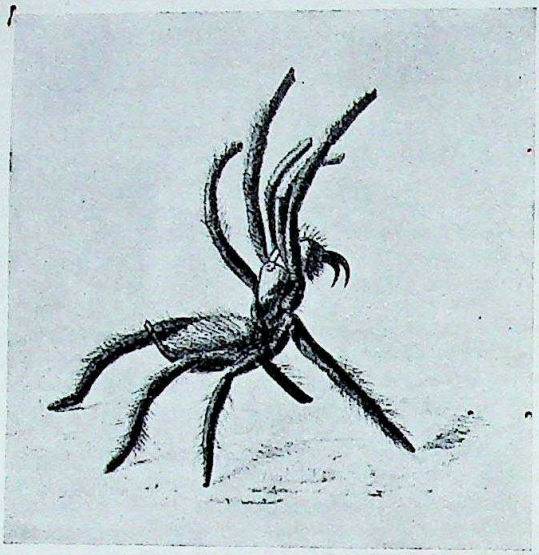

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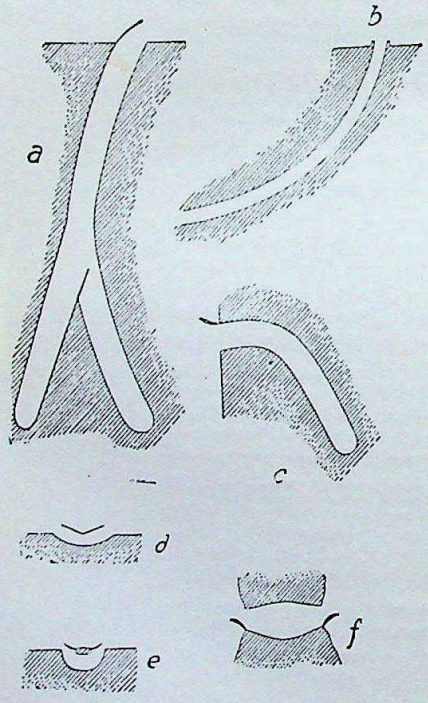

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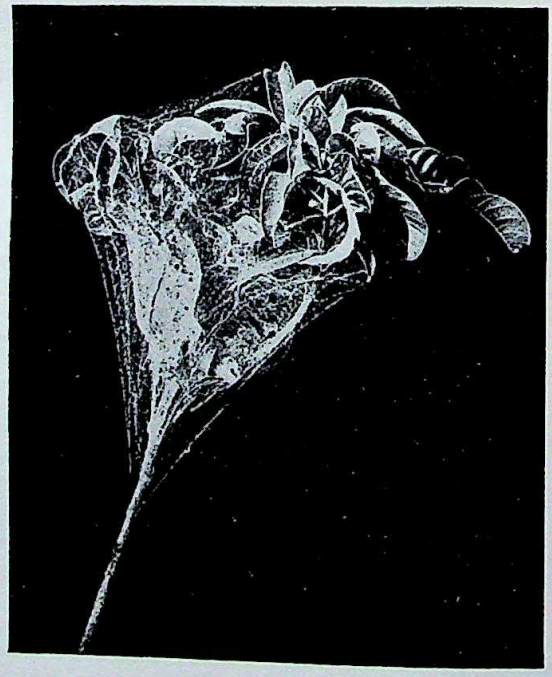

3.

1. *Chilobrachys stridulans* in stridulating attitude. (From Trans. Ent. Soc., London.)
2. Diagrams of nests of "trap-door" spiders : (*a*) *Nemesiellus montanus* ; (*b*) *Damarchus excavatus* ; (*c*) *Acanthodon barkudensis* ; (*d*) *Sason sp.* ; (*e*) *Diplothele walshi* ; (*f*) *Sasonichus arthapophysis*. (Modified from Rec. Ind. Mus.)
3. Web of *Stegodyphus sarasinorum* on mango twig.

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COMMON INDIAN SPIDERS.

BY

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(*With five plates.*)

Spiders are among the most ubiquitous creatures in India, and seem everywhere to have an evil, but so far as I have been able to ascertain quite unproved, reputation as the cause of the painful sore popularly called a "spider-lick". It is surprising therefore to find how little is really known about them and their varied and interesting habits.

The order is divided into two suborders: (1) the Araneae Theraphosæ or Mygalomorphæ characterised (*a*) by jaws which project straight forwards, the fang of each folding straight backwards along its under side and (*b*) by two pairs of conspicuous slit-like stigmata or openings into four corresponding lung-sacs in the anterior part of the ventral surface of the abdomen; and (2) the Araneae Verae or Arachnomorphae characterised (*a*) by jaws which project vertically or obliquely downwards, the fang of each folding along its inner or hinder side and (*b*) by one instead of two pairs of more or less conspicuous pulmonary stigmata, and either one or two stigmata, usually not very evident, opening into tracheal breathing tubes.

The former suborder includes the massive hairy spiders, generally known as Tarantulas, and a number of smaller forms allied to them, such as the Trap-door-spiders. The latter suborder is much the more extensive of the two and includes all the rest. The so-called Harvest-Spiders (order Phalangidea=Opiliones) and Camel Spiders or Jerrymungalums (order Solifugæ=Solpugae) are not true spiders at all since, among other differences, there is no clearly marked division between the cephalothorax and abdomen in the former, and in the latter the jaws are of a different type from those of true spiders.

The large Mygalomorph spiders, commonly known as Tarantulas, are much more massive than any others, though several groups contain species having about the same span. Most of them live in holes in the ground lined with silk, from which they emerge at night to catch their prey. The genus *Poecilotheria*, however, which is confined to India and Ceylon, lives in trees.

All spiders possess a pair of poison-glands, opening near the tip of the fangs, but few seem to have the power of injecting their poison into human beings. It is probable, moreover, that the poison is not automatically ejected whenever the fangs are used, but is under the spider's control. That the popular dread of a Tarantula bite is to a considerable extent justified is proved by the following observation, communicated to me by Dr. Sutherland of Kalimpong. "A boy of 14 years was bitten by this spider [a well grown female of *Macrothele vidua*] on the finger. The pain extended up the arm and down the side. After 24 hours the finger was still swollen". The spider only bites on great provocation, however, and this was the first instance that Dr. Sutherland had known, although the boys in his school frequently kept specimens in captivity. Mr. R. S. Lister, on the other hand, suffered no ill effects beyond a slight local swelling when bitten by a fine specimen of the much larger species *Chilobrachys fumosus*. This may have been due to the fact that we had been making the specimen very angry beforehand, in order to hear the faint rattling sound which is produced as it strikes; and it is possible that it had uselessly emptied its poison-glands before the bite was given, drops having been seen exuding from the tips of the fangs.

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The sound-producing organs of these spiders consist of specialised teeth or spines on the opposed surfaces of the basal joints of the chelicerae and palps, but they are not present in all genera. They were first discovered in *Chilobrachys* (*'Mygale'*) *stridulans*, which is said to make a noise that "is both peculiar and loud; it resembles that made by pouring out small shot on to a plate from a height of a few inches, or, better still, by drawing the back of a knife along the edge of a strong comb". While stridulating "the spider usually rested on the four posterior legs, raising the other four and shaking them in the air, with the thorax thrown up almost at right angles to the abdomen and the chelicerae in rapid motion—assumed in fact, quite a threatening attitude" (*Trans Ent. Soc. London*, 1877, pp. 281-2, pl. VII; pl. reproduced as fig. 1 of present paper). It is interesting to note that the sound produced by *C. stridulans* is much louder than that made by *C. fumosus*, as the stridulating organs of the former are of more highly specialised structure than are those of the latter.

The Trapdoor-spiders belong to two distinct subfamilies, the *Ctenizinae* and the *Barychelinae*, but not all species of these subfamilies close the mouths of their abodes with trapdoors. So far as my observations go, the abodes of the *Ctenizidae* are more or less elongated burrows with a single opening each, whereas those of the *Barychelinae* are shorter and broader with two apertures (see fig. 2). The burrows of some of the *Ctenizidae* (e.g., *Nemesiellus montanus*) are, however, forked near the bottom with an internal trapdoor at the fork which can be pulled across so as to shut off whichever branch the spider choses to hide in (fig. 2*a*). The trapdoors may be thin and "wafer" like falling over the aperture they have to hide; or they may be stout and "cork" like, fitting tightly into the aperture. In either case they are difficult to detect, being composed of silk covered on the outer surface with soil, etc.; but whereas in the former case there is only one layer of silk, in the latter a number of layers are united one on top of another.

Males have to leave their nests in search of mates, but with this exception these spiders probably never go out except through misadventure, resting on the inner side of the trapdoor till a fly alights on the outer side, when the door opens and the fly disappears with lightning rapidity. If a specimen is removed from its nest it appears to have no knowledge as to how to make a new one unless it is provided with some sort of burrow to start with, in which case this will be provided with a trapdoor, enlarged if necessary, and lined with silk. Otherwise the spider wanders about until after a day or two it dies, without attempting to make a new burrow for itself.

Further observations on the habits and nests of various species of Trapdoor spider are much to be desired. All the species so far described have been Mygalomorphs belonging to one or other of the two above mentioned subfamilies; but in Madras there is a species belonging apparently to the Arachnomorph family Zodariidae which likewise closes the entrances to its nest with trapdoors.

The Araneae Verae or Arachnomorphae can be divided into two groups, the *Cribellatae* and *Ecribellatae*, according to whether a cribellum or spinning plate is present or not in front of the spinerettes; and this classification is commonly adopted, though it is by no means certain that it is a natural one, since certain *Cribellate* families appear in other respects to be more closely related to different *Ecribellate* families than to each other.

Stegodyphus sarasinorum (Fam. Eresidae), a common social spider widely distributed throughout India, is among the most interesting of the Cribellatae. It spins dense untidy cobwebs among the branches of trees and bushes, each of these being as a rule the home of a large number of spiders (fig. 3). From these nests sheets of very sticky and elastic silk extend outwards, and woe betide any insect unwary enough to fall into one of them. For immediately the spiders find that anything has been caught they swarm out and together drag it

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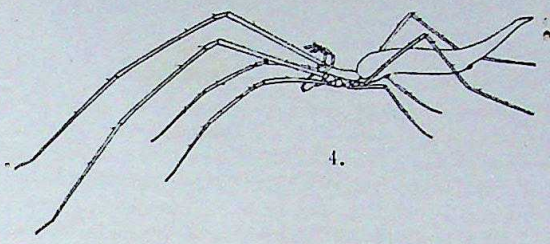

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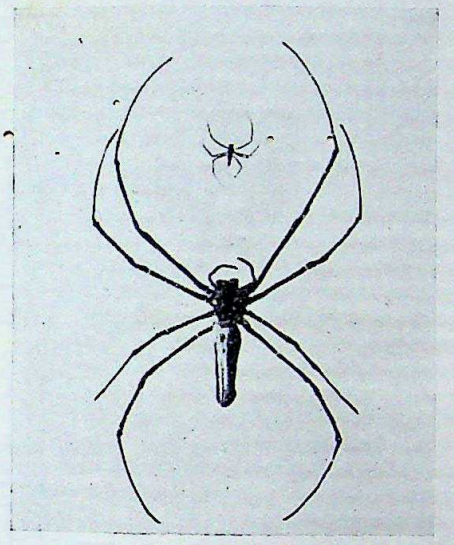

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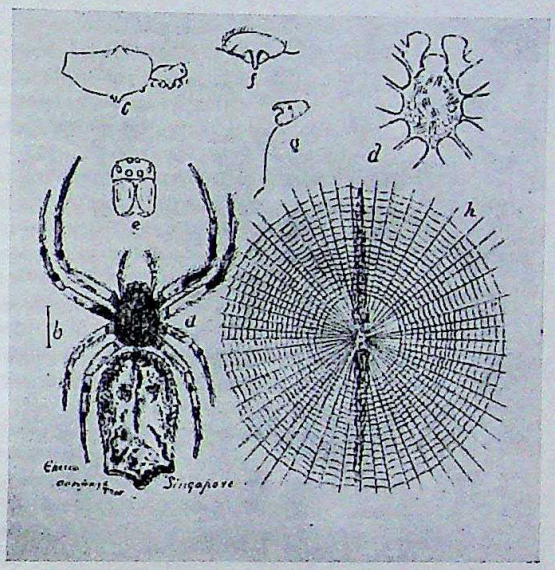

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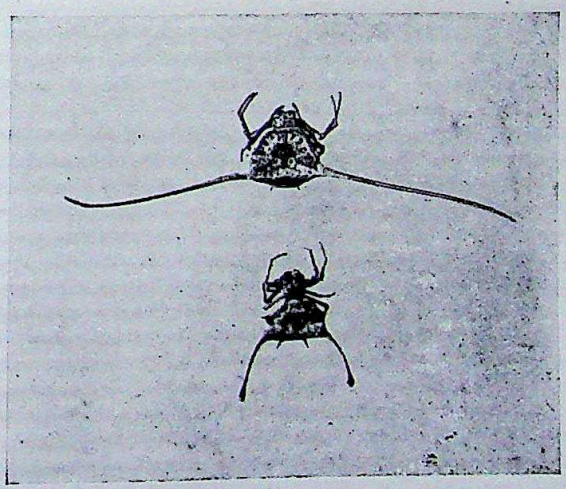

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4. *Eucta javana.*
5. *Nephila maculata* ♂ (above) and ♀ (below) both same scale, about $\frac{1}{3}$ natural size.
6. *Cyclosa confraga*: (*a*) Spider, (*b*) about $\frac{2}{3}$ natural size; (*c*) Profile; (*d*) Sternum and bases of legs; (*e*) Eyes; (*f*) Vulva; (*g*) Do. profile; (*h*) Web (reduced). (From Workman's "Malaysian Spiders").
7. *Gasteracantha arcuata* (above) and *G. remifera* (below).

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to the nest where it is devoured. The nests consequently come to be filled with the dried remains of various insects and often afford a useful clue to the entomology of the locality, including night flying forms such as readily escape notice by day. Further references to the habits of this species, as well as to the different kinds of silk used to give these webs their special characteristics will be found in *Rec. Ind. Mus. XI*, 1915, pp. 534-536, pl. XXV.

Some of the *Dictynidae*, another cribellate family, also spin their webs among foliage, but live in them singly.

The *Psechridae* include certain large spiders with long slender legs which are abundant in damp jungles such as those on the lower slopes of the Darjeeling Hills and the Western Ghats. They spin a somewhat irregular sheet-like web which extends forward from a tubular lair. When lying in wait for their prey, the spiders rest upside down on the under side of their sheets.

The *Uloboridae*, alone among the *Cribellatae*, spin circular snares constructed on a definite geometrical plan with regular radii, like the webs characteristic of the *Argiopidae* among the *Ecribellatae*. Several small species are commonly found in association with the webs of other spiders. A somewhat larger one, *Uloborus geniculatus*, frequents outhouses, etc., where it spins a web with a very characteristic lace-like centre; and yet others spin two horizontal webs, one above the other, the upper one flat and of moderately fine mesh and the lower one funnel-shaped and of much more open mesh.

The majority of spiders with circular snares belong, however, to the family *Argiopidae*, which comprises a large number of species of very varied appearance. The habits of several Indian species are carefully recorded in Hingston's fascinating book "A Naturalist in Himalaya".

The genus *Tetragnatha* includes most of the spiders with long slender bodies and strongly divaricate slender jaws, which spin webs among vegetation around water, but leave them empty by day while they sit on a neighbouring twig or blade of grass, coming out into them at dusk. Other species live among bushes in the jungle, and one at least of these, *T. gracilis*, often spins its web with the twig on which it rests extending right across the centre. The genus *Eucta* (fig. 4), also very abundant near water, differs from *Tetragnatha* only in having the abdomen produced beyond the spinnerettes into a pointed tail. To the same subfamily belongs *Leucauge* (=*Argyroepeira*), a genus of common diurnal spiders, whose striking black markings, with or without orange or green on a background of metallic silver, render many of the species exceptionally handsome.

The next subfamily contains the giant *Nephila*, whose immense web of strong yellow silk is a striking feature of all damp jungles during the rains, when it reaches maturity, its term of life being confined apparently to a single year. The legs of a full grown female have a span of about six inches, the body attaining a length of about two inches and a thickness of about three quarters of an inch. The great disparity between the sizes of the two sexes which is noticeable in many spiders, is illustrated in an extreme form in this genus (see fig. 5), the males being relatively insignificant slender little spiders of a reddish brown colour, of which one or more is commonly to be found residing among the outer whorls of the web of the female.

The genus *Argiope*, which gives its name to the whole family, includes the familiar spider with abdomen transversely banded in dark brown and pale yellow, that sits with its legs stretched out in pairs over a "St. Andrew's cross" (not always complete however) of opaque white silk, with which its web is decorated. Males of this species are also relatively minute and live in small webs on the borders of the web of the female: they are of a uniform brownish colour. Very young specimens decorate the centre of their webs with lace-like silk not unlike that found at the centre of the web of *Uloborus geniculatus* (see above).

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Members of the genus *Cyrtophora* are remarkable for the extreme complexity of their webs, which are probably more elaborate than those of any other spider. Instead of all the radial strands extending outwards from the hub, with interspaces consequently much wider near the periphery than near the centre, additional strands are inserted so as to produce a web of exceedingly fine and uniform mesh. Nor is this all, for these webs are supported in a horizontal position by an extensive irregular network with the help of which the centre of the circle is more or less greatly raised above the periphery, thus forming a sort of tent or dome. One or two species are very common all over India. Their webs are usually found in groups, the irregular supporting framework of which gives them a most untidy and unattractive appearance ; and it is only on closer examination that the exquisitely delicate structure of the circular web is seen. Slender Reduviid bugs, *Eugubinus* spp. feed on the eggs of this spider and are sometimes to be seen making their way about in its webs, which also seem very attractive to certain other species of spiders, mostly belonging to the genera *Argyrodes* and *Uloborus*.

Several species of *Cyclosa* (fig. 6) are to be met with in all parts of the country. The cephalic portion of the carapace is strongly elevated and separated from the lateral and posterior parts by a deep grove, while the abdomen is as a rule ornamented by at least one pair of conical protuberances. The webs frequently have a line of debris extending across one diameter (fig. 6 *h*), with a gap in the centre which is exactly filled by the spider.

The immense genus *Araneus* (=*Epeira*) includes many common forms, for the most part more or less nocturnal and having the same general form and colouration as the common European garden spider of the same genus. The colour is often variable, the structure of the vulva affording the safest means of identification. Another genus of *Argiopidae*, *Gasteracantha* by name, is remarkable for its hard integuments, drawn out on the sides of the abdomen into spines, often of fantastic appearance and sometimes of astounding length (fig. 7).

The allied family *Theridiidae* contains curious genera resembling *Gasteracantha*, as well as a large number of other genera many of which resemble other *Argyopidae* in general appearance. But their webs are always irregular, never circular. Some species live in a curled up dead leaf or even in a specially constructed shelter in the middle of the web. Several small forms, belonging to the genus *Argyrodes*, live in the webs of larger Argiopid spiders, where they are apt to be mistaken by inexperienced collectors for the mates of the rightful owner of the web.

The common Indian house spiders are most useful allies in our attempts to keep down cockroaches, mosquitoes and other noxious insects, and with one or two exceptions should always be welcomed and encouraged to stay. The exceptions are of course those which spin untidy-looking and dust-collecting webs. One of these, *Uloborus geniculatus*, has already been mentioned. But a much more troublesome species is the long legged *Artema atlanta* (fig. 8) which loves to spin untidy cobwebs in any quiet corner of the house, and to rest there upside down with its eggs in its jaws. If it manages to remain till its eggs are hatched a colony will soon be established, for, like the majority of the family *Pholcidae* to which it belongs, it is a spider with strong social instincts.

The large house spider *Heteropoda venatoria* and its allies (family *Clubionidae*) on the contrary spin no webs, beyond neat biscuit-like cocoons around their eggs. They sit flat upon the walls, usually hidden behind pictures and almirahs by day, coming out in search of prey at night. They are often seen in bathrooms and other such places and are unreasonably dreaded by many. In reality they are much to be encouraged. In the commonest species, *H. venatoria*, which is found throughout all tropical countries, the female and young are brown but full grown males are velvety grey and black (fig. 9). Another common

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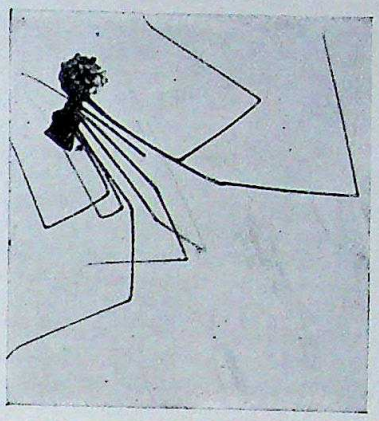

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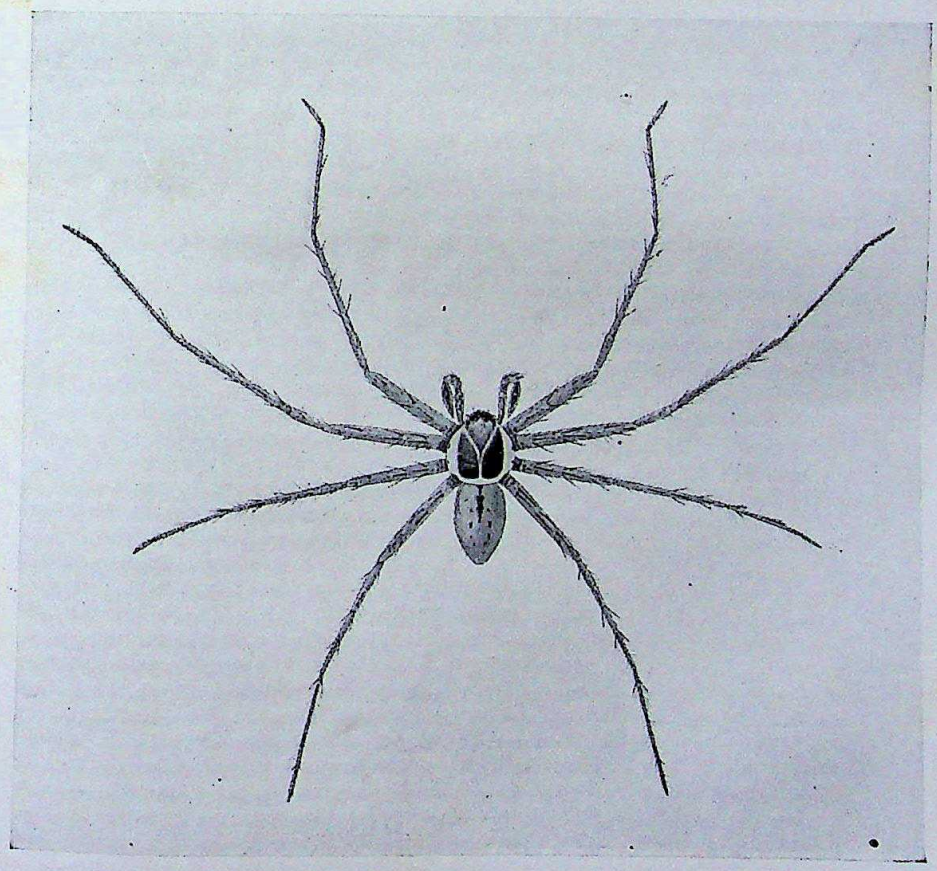

9.

8. *Artema atlanta* with eggs.
9. *Heteropoda venatoria* ♂.

(From photograph and drawing lent by the Zoological Survey of India).

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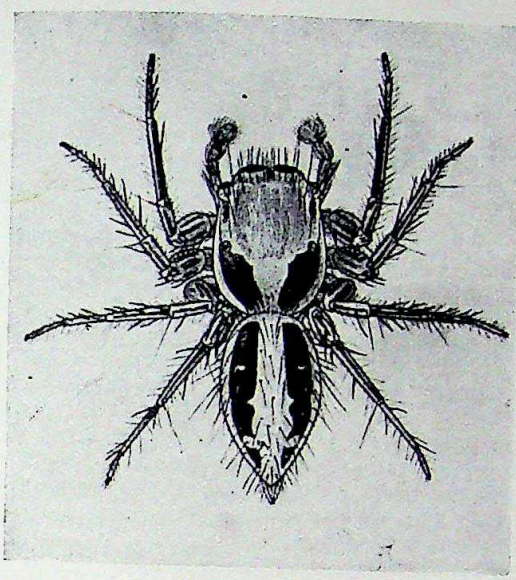

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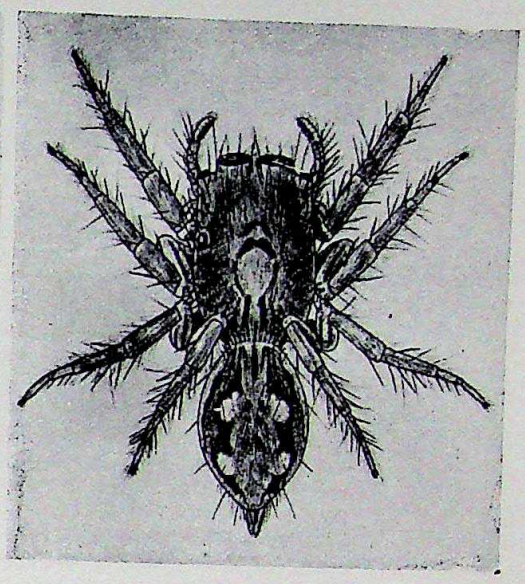

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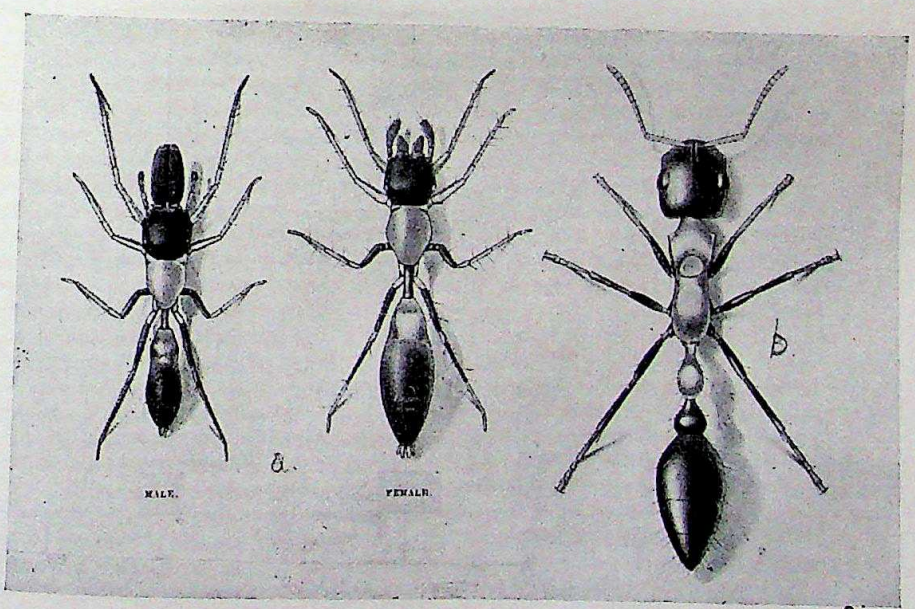

12.

10. *Plexippus paykulli* ♂.
11. *Plexippus paykulli* ♀.
12. *Mymarachne laetus*, ♂ and ♀ (*a*) and its model *Sima rufonigra* (*b*). (From drawings lent by the Zoological Survey of India)

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and useful, though much smaller, house spider is the little jumping spider *Plexippus* (family *Attidæ*), a creature so partial to a diet of mosquitoes that one species has earned for itself the specific name *culicivorus*.

In both *Heteropoda venatoria* and the common *Plexippus* the female is of a dull mottled brown colour, and the male much handsomer. The difference is most marked in *Plexippus* (see figs. 10 & 11) in which the male is not brown at all but strikingly marked with rich black on a whitish ground. I am not aware that anything is known of the courtship of *Heteropoda*. But among the *Attidae* it is well known that this often includes a dance of the male before the female and I have on more than one occasion seen the male *Plexippus* cautiously approaching his mate with uplifted fore-legs, though the dance does not appear to be so well shown in this species as in some that have been investigated.

The *Attidae* are an immense family, and most of its members are jumping spiders not unlike *Plexippus* in general structure, but of very varied size, proportions and colouration. Some of the smaller species are resplendent with amazingly brilliant metallic colours. One interesting group, however, closely resembles various species of ants in form and mode of progression as well as in colour (see fig. 12). Ant-mimicing spiders are found also in other families, such as the *Clubionidae*, to which the large House spider belongs, and the *Thomisidae* or Crab-spiders; and they form a most interesting study. There are also species which mimic the handsomely coloured wingless female Mutilid wasps. Such spiders can, of course, be at once distinguished from their insect models by the possession of four instead of three pairs of walking legs. The first pair is often held up to look like antennae, but is always attached to the lower surface behind the mouth instead of to the upper surface in front of it.

The majority of the *Thomisidae* (Crab-spiders) are broad bodied with widely spreading legs, not unlike the Large House Spider in general build, but with the two hind pairs of legs much smaller than the two front pairs. One of the commonest species, usually greenish or whitish in colour, hides among leaves or flowers to pounce on such insects as may be tempted to visit them.

Several of the smaller species of *Lycosa* (family *Lycosidae* or Wolf spiders) are usually to be found running about in large numbers on open ground, both wet and dry, especially the former. They are brownish in colour, the males sometimes with conspicuous silvery white palps or front legs; they may readily be recognised from spiders belonging to other families by the arrangement of the eyes, the four posteriors being as a rule of relatively enormous size, the medians directed forwards and the laterals outwards, while the four anterior eyes are quite small, and situated in a line below the posterior medians. One or two much larger species of *Lycosa* live in broad burrows, open at the mouth and lined with loosely spun silk. They are often to be found on open grassy land.

A closely allied genus, *Hippasa*, distinguished from *Lycosa* by having the posterior spinerettes much longer than the anterior, instead of about equal to them, is the builder of most of the sheet-webs communicating with a tunnel that are commonly to be found spreading out from walls, bushes, grass and other convenient hiding places. The spiders lie in wait for their prey at the mouth of the tunnel; and when mature they appear to live amicably in pairs, the male guarding the mouth of the tunnel while the female rests inside.

The Lycosidae carry their eggs in a spherical cocoon attached to the spinerettes, and the young when hatched mount on the back of the mother and are thus carried about by her for a time.

The Oxgypidae are a family of more slender and brightly coloured hunting spiders, with eyes of normal size, and very spiney legs. They hide their cocoons among foliage, where they mount guard over them.

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The *Hersiliidae* are much flattened, long legged spiders, with very long pointed spinerettes (fig. 13). They live on tree trunks and walls, adapting their colour to that of their surroundings, and are very difficult to detect until they are disturbed, when they dart to a new resting place and again become practically invisible. Only one species, *Hersilia savignyi*, appears to be common in India.

In the space of a short article like this it is impossible to do more than indicate something of the habits and systematic position of the spiders most likely to come to the notice of field naturalists in India, and a glance at the "Fauna of British India" or at the "Cambridge Natural History" will show how many whole families have been entirely omitted. I am always glad to enlighten members, so far as I am able, as to any spiders they may find which specially interest them. But in spiders as in so many other groups, the literature is both extensive and difficult and specific identification is more often than not impracticable at present.

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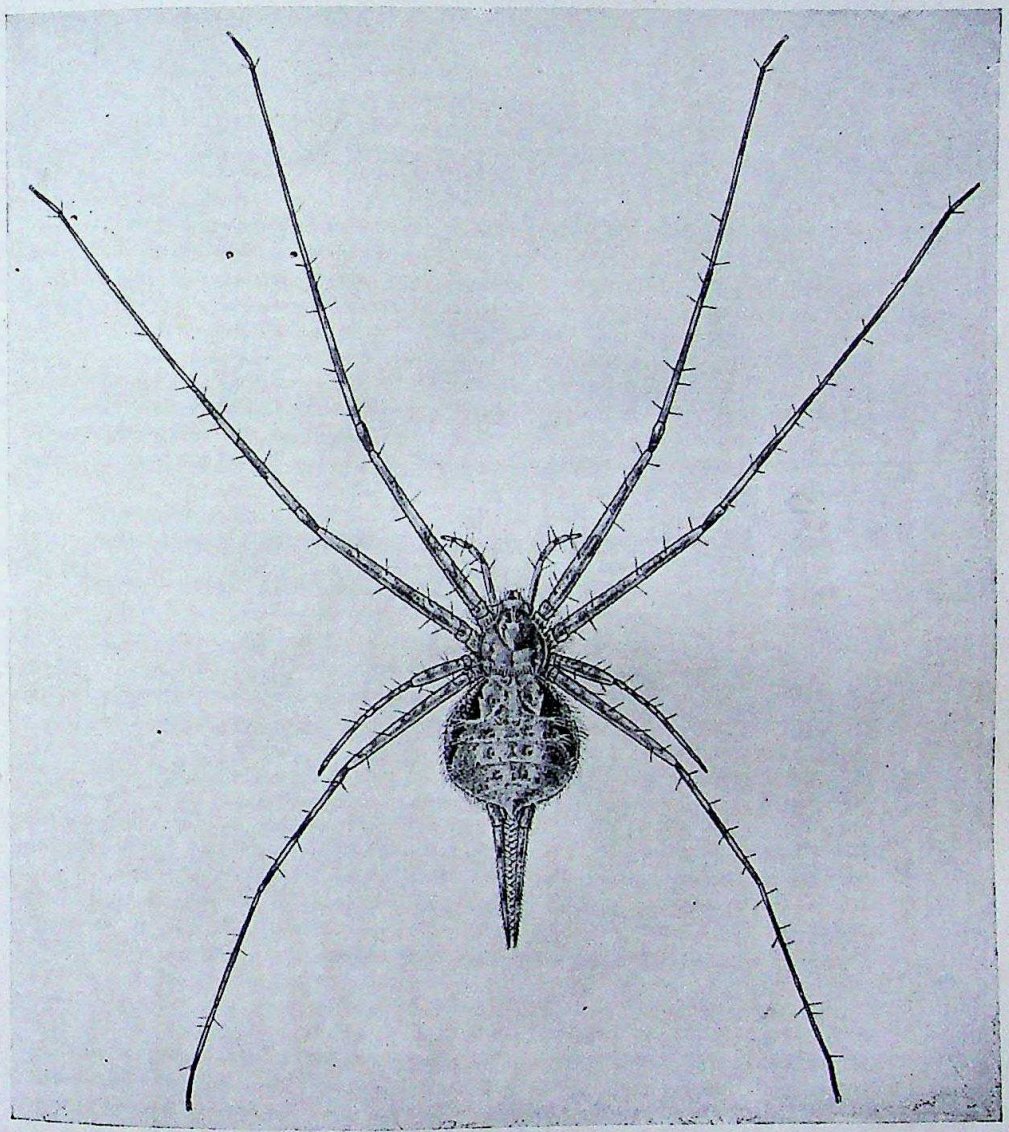

13.

13. *Hersilia savignyii*.
(From a drawing lent by the Zoological Survey of India.)

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A NEW STONE GECKO FROM THE HIMALAYA.

By

Capt. C. M. Ingoldby, R.A.M.C., F.R.G.S., F.Z.S.

In the Summer of 1921 I obtained a series of a small Gymnodactylus at Jutogh near Simla. By the kindness of Miss Procter, I have been able to compare these with specimens from the British Museum collection. I find that they belong to a hitherto unrecognized species, of which one example already existed in the B. M. collection, incorrectly catalogued as G. stoliczkæ. This specimen was presented by Colonel Wall, C.M.G., I.M.S., from Chitral. It is a very young specimen minus the tail. The new lizard appears to be closest to G. stoliczkæ but is separated by the following points:—

G. stoliczkæ.	*G. sp.*
(*a*) Infra-femoral scales large, markedly larger than the ventrals; 4 or 5 in transverse series.	(*a*) Infra-femoral scales small not larger than the ventrals; 9-13 in transverse series.
(*b*) Ventrals larger; 21 rows.	(*b*) Ventrals smaller; 27-33 rows.
(*c*) No præ-anal pores.	(*c*) Præ-anal pores present in the male.
(*d*) External ear-opening minute.	(*d*) External ear-opening moderate.
(*e*) Hind limb over 60 per cent. of the body length.	(*e*) Hind limb 50 per cent. of body length or under.

I have great pride and pleasure in naming the new lizard in honour of its distinguished discoverer.

Gymnodactylus walli sp. n.

Synonym.—Gymnodactylus stoliczkæ Glundachen. Wall. Journ., Bom. N. H. S., Vol. XXI, P. 132.

Specimens. 1♂ 2♀ 1 Hgr. 1 yg.

Localities.—Chitral 1. Jutogh 4.

Type.—A young specimen from Chitral; British Museum Reg. No. 1910-7-12-1.

Description.—Small, elongate, somewhat depressed. Head rather large, little depressed, ovoid; snout slightly longer than distance from eye to ear-opening; ear-opening moderate, oval, largest diameter oblique, measuring in adults 1·5 mm. when fully expanded; eye moderate; limbs moderate; hind limb not more than 50 per cent. of length from snout to vent. Tail cylindrical or slightly depressed.

Lepidosis.—Head, body and limbs covered with numerous sub-equal granules with a few larger granules irregularly intermixed; granules larger on snout and tending to enlargement on the flanks. Subgular scales very small, ventrals moderate, in about 30 longitudinal rows; no lateral fold. Tail ringed with imbricating moderate sized scales, larger below. Each fourth ring shows three large leaf shaped scales, which form longitudinal series, two scale rows apart.

Males with five præ-anal pores; arranged in a flat chevron.

Colouration.—Grey above, irregularly banded or blotched with blackish. Tail with 9 or 10 dark cross bands.

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SCIENTIFIC RESULTS FROM THE MAMMAL SURVEY.

No. XXXIII.

NOTE ON *SORICULUS NIGRESCENS* AND ITS SUBSPECIES.

By

Martin A. C. Hinton.

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In working out the collections made for the Society in Nepal by Lt.-Col. Kennion and the Society's collector, N. A. Baptista, I have had not only to examine all the material representing *Soriculus nigrescens* in the British Museum but to enquire into the history of the older specimens. In connection with the revision of "Blanford" the Zoological Society of London has lent me two of the most valuable treasures in its great library, namely, the volumes containing the original drawings and manuscript notes made by Hodgson in Nepal and Sikkim. By carefully collating Hodgson's specimens with the drawings and notes it is possible now, in many cases, to ascertain exact localities and the dates of collecting for specimens which hitherto, by reason of insufficient and often inaccurate labelling, have been merely so many stumbling blocks in the way of the mammalogist.

Although Blanford (p. 230) states that *Soriculus nigrescens* inhabits "Sikkim and Nepal", my enquiries show that before the work of the Mammal Survey the species was, in reality, only known to occur in Sikkim and Bhutan. All the older, or pre-Blanford, material of this species in the British Museum was received there, at divers dates, as donations from the East India Company; some of the specimens reached the national collection shortly after their arrival in England, while many came in at a far later date when the Company's London Museum was broken up. Gray described (Ann. Mag. N.H. X. p. 261) his "*Corsira nigrescens*" in 1842; giving "India" as habitat; but in his list of 1843 p. 79 the type, (B. M. $\frac{\text{Skin } 42.4.29{\cdot}65}{\text{Skull } 43{\cdot}5{\cdot}31{\cdot}5}$) the only specimen then in the Museum, is mentioned as "*a*. India, Dargelin? Presented by the E. India Company". "Dargelin" is of course a misspelling of Darjiling and as most of the later specimens mentioned below came from this place, and agree with the type in every respect, Darjiling may be accepted as being in all probability the true type-locality. In 1844 a second specimen (44.9.13.7), with the simple locality "India" was received; this probably came from the same source as the type.

Hodgson, as appears from his MS., first became acquainted with the species at Darjiling in January 1848 and in June of that year he sent a pair, marked "No. 7", home to the India House; one of the pair, still bearing a label "Hodgson Nepal No. 7" in Gray's writing, is now before me (B.M. 49.11.23. 16), while the other may be 79.11.21.481 a Hodgson specimen labelled "Sikkim" but without an original number. With the latter, on the break-up of the India Museum, seven other Hodgson specimens (79.11.21.313-318, and 482, the latter being the type of *Sorex sikimensis*, Hodgson) arrived at the British Museum and were then promptly labelled "Nepal". But these still bear Hodgson's original labels (in script) and each is marked "No. 82"; plate 33 in Vol. I of Hodgson's MS. is headed "India House November 1852 No. 82" and notes on that drawing leave no room for doubting that the six specimens in question were all obtained in Darjiling Garden. Blanford also collected specimens at Darjiling, at a much later date, and some of these are before me. With only one definite exception the whole of the material in the collection before the days

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of the Mammal Survey can thus be shown to have come from Darjiling. The exception is a specimen collected, probably about 1838, by Major Pemberton in "Bootan" (No. 79.11.21.484) and received from the India Museum.

The Mammal Survey has now obtained the species in Kumaon and in Nepal. On laying all the material out, rather well marked geographical variation becomes visible in the colour and to some extent in the size and proportions. Four forms would seem now to be recognizable, namely, two in Sikkim, true *nigrescens* from moderate elevations (up to 7,400′) and a somewhat larger form from greater altitudes (up to 12,300′); one in Nepal; and one in Kumaon.

Soriculus nigrescens nigrescens.

Sorex sikimensis, Hodgson.

As explained above, Darjiling is the type locality and no doubt, as regards the type specimen and those collected by Hodgson "Darjiling," refers actually to the town and its immediate vicinity, rather than to the district at large. But as regards the specimens collected by Blanford "Darjiling" would seem to indicate the district. The material now before me from this district is extremely rich for in addition to the early specimens already mentioned we have no fewer than 83 collected at various stations by the Mammal Survey. Of these modern specimens 57 were collected at stations around Darjiling, lying at various heights between 3,500′ (Pashok) and 7,400′ (Ghoom). These agree exactly with the type of *nigrescens*, with Hodgson's specimens, and with most of those collected by Blanford, in having the hindfoot measurement between 14 and 15mm. and the condylo-basal length of the skull between 21.3 and 22.6 mm. The general colour is dark, near "chætura black", more or less overcast with reddish brown above and below; the effect produced being richer and darker than in the subspecies inhabiting Kumaon, though less sombre than in that from Nepal described below. As regards proportions, in a series of 36 specimens, the average lengths of the tail and hindfoot were found to equal respectively 51.5 and 17.8% of the head and body length, but these figures are of course, subject to considerable individual variation.

As to higher stations Lachen (8,800′) and Gnatong (12,300′) these shrews were found to be distinctly larger than in those from the lower altitudes. These may be regarded as representing a distinct subspecies which may be called

Soriculus nigrescens pahari, subsp. n.

Distinguished from the typical form by its slightly larger size and (in the type locality) by its lighter colour.

Size rather large (Head and Body. 82-93, HF. 15-16, condylo-basal length of skull 21.9-23.3mm.) Tail relatively shorter than in *n. nigrescens* its average length in Gnatong specimens equal to 46.5% instead of 51.5% of the head and body measurement.

Colour (in Gnatong specimens) lighter and browner than in *n. nigrescens* approaching the "deep olive" of Ridgway. Specimens from Lachen are as large as those from Gnatong, ("dark greyish olive") and have rather longer tails, (averaging 50% of the head and body measurement); in these respects they approach *n. nigrescens*.

Habitat.—Sikkim, at elevations above 8000′.

Type:—Adult female B. M. No. 15.9.1.56. Original No. 5704. Collected by Mr. C. A. Crump, Oct. 29th, 1914, at Gnatong, Sikkim, Altitude 12,300′.

Remarks:—Two of Blanford's "Darjiling" specimens (90.1.1.5 & 9) are larger than the others and evidently belong to the present form. In all probability they were obtained from one of the higher points in the Darjiling district.

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Soriculus nigrescens caurinus, subsp. n.

Resembling the typical form in proportions, but colour colder and greyer. Size rather larger than in typical *n. nigrescens* (H.F. usually 15mm., condylo-basal length of skull about 22·5mm.) Tail, feet and ears as in *n. nigrescens* shorter than in *n. centralis*.

Colour near "chaetura drab" above and below, but under surface with usually a well marked brownish suffusion. Hands and feet dusky, tail dusky throughout.

For measurements see table at p. 1054.

Habitat :—Kumaon.

Type :—Adult male. B.M. No. 14.7.10. 245. Original No. 3714. Collected September 11th, 1913, at Khati, Kumaon (altitude 7,600′) by Mr. C.A. Crump for the Mammal Survey; presented to the British Museum by the Bombay Natural History Society.

Soriculus nigrescens centralis, subsp. n.

Distinguished from the typical form most readily by its darker colour: and different proportions.

Size rather large (HF. 15-16mm.; condylo-basal length of skull about 23) Tail, feet and ears relatively longer (see table at p. 1055). Colour very dark near "dark mouse grey" of Ridgway; dorsal and ventral surfaces alike, the latter perhaps a little greyer. Hands, feet and tail dusky; but the terminal 5mm. of the tail white in all four specimens examined. For measurements see table at p. 1055.

Habitat :—Nepal.

Type :—Adult male B.M. No. 22-5-16-17 Original No. 322 collected Jan. 1st, 1921, by N. A. Baptista for the Mammal Survey at Bouzini Nepal; presented to the British Museum by the Bombay Natural History Society.

SORICULUS NIGRESCENS.

A. External measurements and proportions.

	Millimetres.				Percentages.
	Head & Body.	Tail.	Hind-foot.	Ear.	H. & B. Tail. HF. Ear (percentages).
Soriculus n. nigrescens.max.	88.	47.	15.	10.	
min.	70.	34.	14.	7.	
average of 36 :—	80·2.	41·3	14·3	8·4	=100–51·5–17·8–10·4
Soriculus n. pahari type	84.	38.	15.	8.	
max.	93.	47.	16·5	10.	
min.	82.	36.	15.	8.	
average of 26 :—	87.	42·5	15·4	8·6	=100–48·9–17·7–9·9

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	Millimetres.				Percentage.
	Head & Body.	Tail.	Hind-foot.	Ear.	H. & B. Tail. HF. Ear. (percentages).
Soriculus n. caurinus type	88.	46.	16.	8.	
max.	94.	48.	16.	9.	
min.	79.	41.	14.	7.	
average of 10 :— ..	84.	43·7	15.	8.	=100–52–17·8–9·5
Soriculus n. centralis. type	76.	47.	16.	10.	
max.	90.	47.	16.	10.	
min.	74.	44.	15.	10.	
average of 4 :— ..	80.	45·5	15·75	10.	=100–57–19·7–12·5

SORICULUS NIGRESCENS.

B. Skull measurements (in millimetres).

	S.n. nigrescens.			*S.n. pahari.*			*S. n. caurinus.*			*S.n. centralis.*	
B. M. No.	43 5 31 25	15 9 1 58	15 9 1 61	15 9 1 56	15 9 1 54	15 9 1 51	14 7 10 245	14 7 10 244	14 7 10 246		305
	Type	min	max	Type	min	max	♂ Type	♂	♀	Type	♂
Extreme length ..	=	20·6	22·6	21·9	22·3	22·8	22·8	22·6	22·6	22·3	=
Greatest width ..	=	10·8	12·1	11·6	11·7	11·3	12·2	11·9	11·7	12·3	=
Tooth row 1^1–M^3 ..	9·7	9	10·1	9·9	10·1	10·4	10·6	10·2	10·3	10·2	10
Teeth (state of wear)	mod.	much	mod.	mod.	slight	much	mod.	mod.	mod.	mod.	much

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SCIENTIFIC RESULTS FROM THE MAMMAL SURVEY.

No. XXXIV.

THE HOUSE RATS OF NEPAL.

By

Martin A. C. Hinton.

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A large part of the historic Hodgson collection forms one of the principal treasures in the National Collection of mammals. But hitherto this material, which should always have been one of our chief guides to Himalayan mammalogy, has, to a large extent, constituted merely a stumbling block in the way of the student. Unfortunately Hodgson rarely labelled his specimens in English; and early curators, impressed with Hodgson's long association with Nepal, were too prone to assume that all his specimens came from that country unless some other locality was specifically stated. But Hodgson collected from many sources, such as Kashmir, Sikkim and Tibet, besides Nepal. The confusion which such imperfect labelling introduced may be imagined; the result of it was that for many years the Hodgson material was deprived of its real scientific value. When preparing my report on the Indian House Rats for this Society some years ago, I found it impossible to deal satisfactorily with the Hodgson material and with great reluctance I had to brush it almost wholly aside.

Two recent events have enabled us to rehabilitate this Collection to a considerable extent. In the first place the authorities of the Zoological Society of London have lent us the original notes and drawings made by Hodgson so that we are able to collate them with the specimens on which they were based. By this means it has been found possible to ascertain the exact localities of many specimens of which the real provenance was previously unknown and to identify a good many of Hodgson's co-types. Secondly, large collections have been made in Nepal for the Mammal Survey by Lt.-Col. Kennion and this Society's collector N. A. Baptista. With this modern material it is possible to form opinions as to the status of the Nepalese forms, which, in many cases, could not be based satisfactorily upon the scanty and often imperfect typical specimens.

A general report upon the Nepal collections will appear shortly in this Journal. The present paper is intended to clear up some of the questions relating to the status and relationships of that most difficult group, the House Rats of Nepal. As is well known Hodgson asserted these animals to be distinguishable from those of neighbouring countries, *e.g.*, Sikkim, and he bestowed names upon several forms. He was a most acute and energetic observer, with views for the most

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part far in advance of those held by the majority of his contemporaries; and it is with great pleasure and satisfaction that I now find myself able to confirm some of the results, derisively received in the past, at which he arrived in 1845.

1. *Rattus rattus arboreus*, Buch. Ham.

This subspecies enters Nepal, where it appears to be restricted to the Terai. The specimens now before me are indistinguishable from typical examples from Bengal.

Material examined.—The following are the external measurements, taken in the flesh by the collector, of those examples of which the skull measurements are recorded in Tables I and II:—

No.		Head and Body.	Tail.	Hindfoot.	Ear.
35	♀ Bairia	146	220	35	21
71	♂ Hazaria	160	226	35	24
70	♀ „	156	225	33	26

2. *Rattus rattus rufescens*, Gray.

Bairia, ♂ 1; Hazaria, ♂ 4, ♀ 4.

Quite typical examples. Evidently the "parasitic" phase *R. r. arboreus* as it occurs in the Terai.

3. *Rattus rattus brunneusculus*, Hodgson.

1841. *Mus decumanoides* (in part). Hodgson. J. A. S. B. x., p. 915 (nomen nudum.)

1845. *Mus brunneusculus*, Hodgson. Ann. Mag. N. H. xv., p. 267.

1881. *Mus alexandrius*, var. *rufescens*, Thomas. P. Z. S. 1881, p. 533.

Mus rattus, Blanford (in part.)

Size small (HF. about 34 mm.; condylo-basal length about 40). General form as in normal Indian subspecies of *R. rattus*. Mammæ 3-3=12.

General colour of upper parts rather bright brown. Underparts pure white with the lateral lines of demarcation sharply defined.

Skull rather lightly built with the frontal beads normally developed. As compared with that of *brunneus*, it differs in having the braincase relatively broader, the temporal ridges more closely approximated posteriorly, the postmolar region shorter, the nasals, palate and tooth rows longer. For skull measurements see tables at pp. 1064-66.

Type:—B. M. 45.1.3.353. Nepal. Presented by B. H. Hodgson, Esq.

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Material examined.—In addition to the type, the following specimens, collected for the Mammal Survey by Lt.-Col. R. E. Kennion and the Society's collector N. A. Baptista, have been examined.—Nagacot ♂ 4, ♀ 6; Bouzini, ♂ 2, ♀ 2; Chalna-Khel ♂ 2, ♀ 2; Thankot, ♂ 1, ♀ 2; Pattibhagan (8,000′), ♀ 1; Sipari, ♂ 1, ♀ 1; Kakhani (7,000′), ♂ 1; Ramchi (11,000′), ♀ 1; Total 29 adults.

The following are the dimensions of the more important specimens :—

No.		Head and Body.	Tail.	Hindfoot.	Ear.
61	♀ Pattibhagan	..	233	34	22
270	♀ Thankot	162	208	33	24
273	♂ „	160	205	35	24
241	♂ Chalna-Khel	165	210	35	25
296	♂ Sipari	177	230	36	25
365	♂ Nagarkot	165	214	33	24
357	♂ „	140	178	33	23
124	♀ „	167	197	31	25
313	♂ Bouzini	140	190	32	24
2	♂ Kakani	160	180	33	22
193	♀ Sunachir	185	202	35	23
	Average of 27 adults : ..	162	203	33·4	24·3
	Average per cent. of head and body measurement.	100	126	20·7	15

This subspecies appears to be most closely related to *R. r. sikkimensis*, agreeing with the latter in possessing 12 mammæ, in general outward appearance and coloration, and in the general character of the skull. The proportions, however, seem to be rather different. In *sikkimensis* the head and body and hind foot measurements in adults average 154 mm. and 32.2 respectively, the maximum values in the long series examined being 174 and 35; in the present form the corresponding averages are 162 and 33.4, the maxima being 186 and 36. The Nepal form would seem to attain a greater weight than *sikkimensis*: for according to Hodgson *brunneusculus* weighs 9 to 10 oz., while no specimen of the many weighed in Sikkim by the Mammal Survey exceeded 7 oz. On the other hand the skull of *brunneusculus* averages slightly smaller and is relatively a little broader throughout than that of *sikkimensis*. The temporal ridges are more normally bowed as a rule than in the latter, and they are rather less closely approximated behind.

4. *Rattus rattus brunneus*, Hodgson.

1841. *Mus decumanoides* (in part), Hodgson. J. B. A. S., x., p. 915 (nomen nudum).

1845. *Mus brunneus*, Hodgson. Ann. Mag. N. H. xv., p. 266.

1881. *Mus decumanus*, Thomas. P. Z. S. 1881, p. 532; Blanford No. 274 (in part; *nec* Pallas).

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Size large (H.F. about 38 mm.; condylo-basal length about 44). General form, robust and heavy, the animal presenting a strong superficial resemblance to the Brown Rat (*R. norvegicus*—"*decumanus*"). Essential characters (tail, ears, feet and skull) those of *R. rattus*. Mammæ 3-3=12.

General colour of upper parts dark brown, more or less grizzled with grey or black. Under parts, in the typical form, dusky with a more or less well-marked rusty or buffy suffusion—the ventral hairs having slaty bases and lighter tips. In "wild-coloured" individuals the underparts pure white, the ventral hairs being white to their bases.

Skull strongly built, with unusually coarse frontal beads. As compared with that of the other Nepalese sub-species it is characterised by its larger size, relatively narrow braincase, the comparatively wide separation of the temporal ridges posteriorly, longer postmolar region, shorter nasals, palate and tooth-rows. These differences are illustrated by the measurements in Table II.

Co-types.—Three specimens in the British Museum (B. M. 43.1.12.64, 69 and 131) are co-types of Hodgson's species. Of these I select B.M. 43.1.12.69 as the lecto-type, the other two becoming lecto-paratypes.

Material examined.—Besides Hodgson's specimens I have before me the following specimens collected in Nepal for the Mammal Survey by Lt.-Col. Kennion and N. A. Baptista:—Ferping, ♀ 5; Hathiban, ♀ 7; Chalna-Khel, ♀ 1; Katmandu, ♂ 1; Godaveri, 7,000′, ♀ 2; Changoo, ♂ 2, ♀ 5 (including 2 juv.) Total 29 (27 adults).

The following are the external measurements of the more important specimens:—

No.		Head and Body.	Tail.	Hindfoot.	Ear.
	a. Typical *brunneus*:—				
208	♀ Hathiban	180	208	37	27
194	♂ ,, ...	177	230	39	28
233	♀ Ferping	170	212	38	27
237	♀ ,, ...	184	235	39	28
	Average of 13 adults ..	174	215	37.7	27.2
	Average per cent. of head and body measurement ..	100	124	21.7	15.6
	b. Wild coloured *brunneus*:—				
347	♀ Changoo	165	203	35	..
354	♀ ,, ...	162	215	35	26
352	♂ ,, ...	184	..	37	27
	Average of 5 adults ..	168.6	201	35.6	24.4
	Average per cent. of head and body measurement.	100	119	21.2	14.5

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Sharply contrasted with all other Indian forms of *Rattus* by its large size, great weight and robust and strongly ridged skull, this extremely interesting rat presents a strong superficial resemblance to *R. norvegicus*, now the Common Rat of Europe. Hodgson, deceived by this likeness, thought the present animal "as nearly allied to *decumanus* as" *Bandicota nemorivaga* is "to the Bandicoot"; and since, to within a few days ago, the skulls of his specimens remained concealed within the skins, no subsequent writer appears to have had any more accurate notion of its affinities. This form puzzled me very much when I was preparing my former account of the House Rats of India, and in the end I thought it better to await the coming of modern material from Nepal before attempting to deal with it.

The specimens collected by the Survey in Nepal agree exactly with those collected by Hodgson in that country eighty years ago; and it is now perfectly clear that *brunneus* is a form of *R. rattus* and has nothing whatever to do with *R. norvegicus*. If it were not for the fact that some of the specimens (*e.g.*, Ferping No. 237, Godaveri No. 134, and all those from Changoo) have pure white bellies and that their skulls were slightly smaller than those of dusky bellied *brunneus* (see Table II), one could regard *brunneus* as a full species of the *rattus* group, confined to Nepal. But the specimens just mentioned are on the whole intermediate between *brunneus* on the one hand and *brunneusculus* and other Indian subspecies on the other, although it is to be noted that the skull proportions, apart from the absolute size, remain much the same in both light-bellied and dark-bellied *brunneus*.

Personally I am inclined to think that *brunneus* is a local "parasitic" development from the true wild form (*R. r. brunneusculus*) of Nepal. By becoming more strictly commensal with man these rats have obtained access to larger food supplies; with increased nutrition there has come increased bodily size. On the other hand parasitic habits have had their usual effects upon the skull; the temporal muscles have become relatively weak, so that the ridges marking the upper limits of the origins of those muscles are less closely approximated posteriorly than in the wild form; the tooth-rows shortened, etc. The unusual thickening of the frontal beads is also I think a character of degeneration, comparable, perhaps, with that peculiar thickening of the supraorbital ridges seen in monkeys which have lived in captivity.

5. *Rattus rattoides*, Hodgson.

1841. *Mus rattoides*, Hodgson. J. A. S. B., x., p. 915 (no description.)

1845. *Mus rattoides*, Hodgson. Ann. Mag. Nat. Hist. xv., p. 267.

1891. *Mus rattus*, Blanford (in part.)

1914. *Epimys vicerex*, Wroughton (*nec* Bonhote). J. B. N. H. S., xxiv. p. 489.

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1920. *Rattus vicerex* (in part), Wroughton. J. B. N. H. S. xxvi., p. 798; Hinton, *ib.*, p. 918.

Closely allied to *R. vicerex*, Bonhote, but differing in the following characters :—

Tail relatively longer, its length averaging 133 per cent. of the head and body measurement.

Coat harsher and looser, the whitish "spines" and long black hairs being more numerous. General colour, above and below, darker and greyer than in typical *vicerex* from Simla, the underparts much less strikingly contrasted with the flanks. The darkening of the belly is due to the fact that the ventral hairs have slatey bases instead of being pure white throughout. Tips of ventral hairs usually silvery but sometimes yellowish, the underparts then having a more or less evident rusty suffusion. Tail, in the majority of specimens, dusky above and below, lacking the marked bicoloration characteristic of, and constant in true *vicerex*. In a few Nepalese specimens the tail shows faint traces of bicoloration ; and in two or three it is well-marked Mammæ 3-3=12 (as in *vicerex**.)

Skull with relatively still broader nasals, peculiarly expanded interorbital region, smaller and still less inflated bullæ, and slightly longer tooth-rows.

For measurements see Tables at pp. 1065-1066.

Lecto-Type.—B. M. No. 43. 1. 12. 66. Collected in Nepal and presented to the British Museum by B. H. Hodgson, Esq.

Habitat.—Nepal and Sikkim.

Material examined :—In addition to the two co-types in the Hodgson collection the following collected in Nepal for the Mammal Survey are now before me :—Katmandu, 1 ; Nagarkot, ♂ 7, ♀ 7 ; Ferping, ♀ 3, Hathiban, ♂ 2, ♀ 1 ; Thankot, ♂ 3 ; Changoo, ♂ 2 ; Sipari, ♂ 1 and Ramchi (11,000′), ♀ 1. Total from Nepal 30 adults.

From Sikkim I have 13 specimens, all collected by the Mammal Survey, obtained at the localities Chuntang (5,350′). Ghoom (7.400′), and Batasia (6,000′).

The following are the external measurements of the more important specimens :—

No.		Head and Body.	Tail.	Hindfoot.	Ear.
251	♀ Ferping	170	225	33	26
191	♂ Hathiban	160	210	35	27
219	♂ „	155	212	35	26
281	♂ Thankot	156	205	34	25
367	♀ Nagarkot	164	208	34	25
	Average of 27 adults ..	157	193	33.2	24.8
	Average per cent. of head and body measurement ..	100	133	21.2	15.8

* Wroughton "Summary" (J. B. N. H. S. xxvi., p. 798) gives the mammæ as 10, but I find 12 to be present normally in *vicerex*.

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Remarks.—The rediscovery of this species, described so long ago by Hodgson, is one of the most interesting results obtained by the Mammal Survey in Nepal. Hodgson in describing *rattoides* called it the "Black Rat of Nepal" and stated it to be "as similar to the Black Rat of Europe as the foregoing [*brunneus* and *brunneusculus*] is to our brown rat." His very brief description is as follows :— "Above dusky or blackish brown, below dusky hoary. Limbs, dark; fingers, pale; tail decidedly longer than the body and head. Long piles sufficiently numerous; weight 5—7 oz." This (apart from the measurements †), as far as it goes, so accurately fits both Hodgson's co-types (hitherto imperfectly labelled) and the material recently collected for the Mammal Survey that I have no hestitation in identifying the present species with "*Mus rattoides*" an identification confirmed by comparison with the original coloured drawing in the Library of the Zoological Society (Hodgson, MS. Vol. I, p. 197, Fig. 2).

Comparison shows further that the specimens collected by the Mammal Survey in Sikkim, which were referred to "*Epimys vicerex*" by Wroughton (J. B. N. H. S. xxiv, p. 489) "with some hestitation," because "the characteristic white belly and bicoloured tail are much less marked than in true *vicerex* and even than in our Kumaon specimens," agree so closely with those from Nepal that they too must be referred to *rattoides*.

There can be no doubt that *rattoides*, *vicerex* and *turkestanicus* are all closely related to each other; and it may prove hereafter that all three represent merely sub-specific forms of a single species for which the name *rattoides*, as being by far the oldest name, must be used. In the present state of our knowledge it is better, however, to regard them as distinct species. It is to be hoped that members of the Society residing in Simla and in North-Western India will endeavour to collect a good series of the rats of this group, easily recognisable, in the region specified, by the conspicuously bicoloured tail; for the material at present existing in the National Collection is wholly insufficient for the purpose of determining the true status of *R. vicerex*. Our present knowledge may be summed up in a few words. *R. rattoides* of Nepal and Sikkim makes a nearer approach in external characters to *R. rattus*, but departs further from the latter species in skull structure; while exactly converse statements apply to *R. vicerex* from Simla and districts to the north-west of that station. The specimens collected in Kumaon by the Survey are of a somewhat intermediate character, having an external appearance something like that of *rattoides*, coupled with a skull more like that of *vicerex*.

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† Hodgson's measurements are: Head and body, 7$\frac{1}{2}$"; tail, 8$\frac{3}{4}$"; hindfoot, 1$\frac{1}{2}$"; ear, $\frac{7}{8}$": which equal 198-230-40-23. The head and body and hindfoot measurements are too large, for, as is the case with other species, they were taken in a manner different from that now in vogue.

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4. *Rattus nitidus*, Hodgson.

1845. *Mus nitidus*, Hodgson. Ann. Mag. N. H. xv, p. 267 (Nepal.)
1849. *Mus æquicaudalis*, Hodgson. *Ib.* (2) iii, p. 203 (Darjiling)
1881. *Mus alexandrinus* var *nitidus* (in part), Thomas. P. Z. S. 1881, p. 533.
1891. *Mus rattus* var *nitidus* (in part), Blanford. Mammalia, p. 407.
1914. *Epimys nitidus*, Wroughton. J. B. N. H. S. xxiii, p. 296; xxiv, p. 489.
1196. *Rattus nitidus*, Wroughton, *Ib.*, xxiv, p. 782; Hinton, *Ib.*, xxvi, p. 412.

Material examined:—Ferping, ♀ 1; Thankot, ♂ 1; Changoo ♂ 1, ♀ 1.

The following are the external measurements of the more important specimens:—

No.		Head and Body.	Tail.	Hindfoot.	Ear.
272	♂ Thankot	160	184	36	23
345	♀ Changoo	160	..	34	23

This rat is apparently rare in Nepal, only four specimens of the long series of house rats collected by Baptista being referable to it. These specimens are important since they confirm the identifications of the material collected by the Mammal Survey in Kumaon and Sikkim with Hodgson's species. Measurements supplementing those given in my earlier paper are included in the Tables at pp. 1065-1066.

The skull measurements and proportions recorded in the following table correspond with and supplement those given in my earlier paper (J. B. N. H. S. xxvi, pp. 716 and 910).

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TABLE I.—*Measurements of skulls of Nepalese members of Rattus rattus group, (in millimetres.)*

	R. r. arboreus.			*Rattus rattus brunneusculus.*												*R. rattus* (intermediates) Changoo.		
	Bairia.	Hazaria.		Nepal Type.	Pattibhagan.	Thankot.		Chala khel.	Sipari.	Nagarkot.			Bouzini.	Kakani.	Sunachir.			
Dimension No.	35 ♀	71 ♂	70 ♀	45 1—3 353	61 ♀	270 ♀	273 ♂	241 ♂	296 ♂	365 ♂	357 ♂	124 ♀	313 ♂	2 ♂	193 ♀	347 ♀	354 ♀	352 ♂
Teeth: State of Wear:—	Mod. worn.	Mod. ½ worn.	½ much worn.	Mod. worn.	½ worn.	½ worn.	Much worn.	½ worn.	½ much worn	½ worn.	Mod. ½ worn.	½ much worn.	½ worn.	Mod. worn.	Mod. ½ worn.	½ worn.	½ worn.	½ worn.
1 ..	38·3	39·5	40·5	36·7	41·4	38·8	40·4	41·1	43·6	41·5	36·4	37·4	38.7	36·9	40·8	40·3	42	44·9
2 ..	40·8	41·3	42·2	38·8	43·8	41·3	42·8	43·3	46·4	43	38·8	39·5	41.4	38·6	44	42·6	43·7	46·9
3 ..	19·4	20·4	21·1	18·2	20·9	20·3	21·6	21·8	21·6	21·3	18·7	20·8	20.1	19·8	20·2	21·5	..	22·7
4 ..	6·1	5·9	5·8	5·2	6	5·9	6·5	6·4	6·1	6·4	5·6	6	6.1	5·6	5·8	5·8	6	6·4
5 ..	16·6	16·3	16·7	15·2	16·3	16·5	16·2	16·7	16·3	16·5	15·7	16·8	16.4	16·2	16·1	15·7	16·8	16·6
6 ..	14·8	15	15	13·7	13·9	14·1	13·4	14·7	13·5	14	13·2	14·4	14.3	13·9	14·2	13·2	14·7	14·4
7 ..	13·2	12·4	12·2	12·3	12·3	10·2	10·7	11·2	10·5	11·5	11·1	10·8	11·4	12·8	11·8	11·7	12·6	13·2
8 ..	16·2	16·1	16·5	15·1	16·7	15·6	15·9	16·9	16·8	16·2	14·3	15	15.5	16·1	16·7	16·2	16·7	17·1
9 ..	9·4	9·7	9·7	9	10·1	10	9·6	10	9·9	10	8·7	9·8	9·3	9	9·4	9·7	9·8	10·2
10 ..	17·5	18·4	18·3	16·7	19·4	17·3	17·8	18·6	19·5	19·3	16·4	16·1	17·5	17·5	18·8	19·3	19·5	21
11 ..	10·2	10·6	11·2	9·6	11·3	10·1	10·2	10·5	11·3	11	9·9	9·9	10·1	10·5	11	11·4	11·3	11·6
12 ..	14·9	14·7	15·5	14·2	16·2	15·6	16·4	16·1	17·8	15·8	13·6	14·5	15·3	13·7	16	15	15·6	17·2
13 ..	4·7	4·6	4·6	4·1	4·9	4·2	4·6	5	5·2	5	4·2	4·3	4·3	4·2	4·5	4·5	4·2	5·1
14 ..	22·1	21·9	23·7	21	23·4	22·5	23·8	23·4	25·3	23·8	21·1	21·8	22	20·6	23·3	22·6	23·7	25·7
15 ..	10.9	10·5	11·5	9·5	10·9	10·8	10·9	11·1	12·6	11·2	9·9	10·4	10	9·9	10·9	10·3	11·6	12·5
16 ..	7	7·5	8·6	7·1	8·3	7·5	8	7·8	8·5	8	7·4	7·2	7·4	6·8	8·1	7·4	7·8	8·2
17 ..	2·8	2·9	3·1	1·9	2·5	2·4	2·5	2·4	3	2·7	2·5	2·6	2·6	2·7	2·8	2·4	2·4	2·4
18 ..	7·3	7·8	8·2	6·5	7·6	7	7·2	7·6	8·3	7·4	6·9	6·9	7·1	7·3	7·6	7·3	7·9	8·1
19 ..	4·2	4·3	4·6	4	4·8	4·1	4·8	4·5	4·6	4·7	4	4	4·3	4·4	4·9	4·6	4·6	4·8
20 ..	6·2	6·9	6·5	6·7	7·4	7·1	7·3	7·1	7·4	7·1	7	7	7·6	6·4	7·6	7	7	7·4

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TABLE I.—*Measurements of skulls of Nepalese members of Rattus rattus group, (in millimetres)*—(concluded.)

	R. r. brunneus.						*R. rattoides.*					*R. nitidus.*	
	Type.	Katmandu.	Hathiban Ferping.				Ferping.	Hathibam.		Thankot.	Nagarkot.	Thankot.	Changoo.
Dimension No.	43 1—12 69	74	208 ♀	194 ♂	233 ♀	237 ♂	231 ♀	191 ♂	219 ♂	281 ♂	367 ♂	272 ♂	345 ♀
Teeth: State of Wear:—	Mod. worn.	Mod. worn.	Mod. worn.	Mod. ½ worn.	½ worn.	Much worn.	½ worn.	½ worn.	½ to Much worn.	½ to Much worn.	½ to Much worn.	Much. worn.	Much worn.
1 ..	44·2	43·9	42·2	44	42·9	45·2	39·2	39·7	40·9	39·1	39·3	40·1	40·7
2 ..	46·2	46·7	44·5	45·3	43·7	47·3	41·6	42	43	41·3	41·6	43	43·6
..	22·9	22·5	22·6	22·1	21·4	22·6	20·2	21·7	21·6	21·1	20·7	21	21·1
4 ..	6·6	6·6	6·6	6·4	6·1	6·7	6·5	6	6·5	6·8	5·8	6	6·3
5 ..	17·8	17·6	16·9	16·6	16·7	16·6	16·6	16·6	16·4	16·7	16·5	16·4	16·6
6 ..	15·7	15·1	15·1	14·8	14·4	14·7	14·3	14	14·1	13·9	13·5	14·7	14·7
7 ..	13·6	12·8	14·2	12·9	12·8	12·1	12·6	11·6	12·3	12·3	11·7	13·2	12·7
8 ..	17·8	17·2	18·5	17·3	17·4	17·8	15·7	15·9	16·2	16·1	15·5	16·7	16·1
9 ..	10·4	10·2	10·3	10·4	10·6	10	9·3	9·6	9·8	9·5	9·6	9·8	9·6
10 ..	20·6	20·4	20·2	20·6	20·4	21	17·5	18	18·7	17·7	18·1	18·3	18·5
11 ..	11·6	11·7	11·4	12·3	11·7	11·9	10·2	10·4	11	10·3	10·3	10·2	9·9
12 ..	17	16·9	14·9	16·6	16	17·7	15·6	15·6	16·3	15·6	15·3	18·5	18·2
13 ..	4·9	5·3	4·9	4·6	4·3	4·8	5·1	5·1	4·9	5·1	4·8	4·5	4·8
14 ..	25·5	24·8	23·5	24·9	24	25·8	21·8	22·4	22·9	21·2	22	23·3	23·6
15 ..	12	12·3	11·2	12·4	11·4	12·4	10·5	11·4	11·2	10·5	10·8	11·7	11·7
16 ..	8·5	9	8·2	8	8	8·4	7·8	7·6	7·3	8	7·6	8·3	8·1
17 ..	2·9	3·1	2·6	2·9	2·4	2·6	2·2	2·5	2·3	2·5	2·6	2·5	3·
18 ..	7·9	8·2	8·1	8·1	8	8·3	7·8	7·8	7·7	7·8	7·6	7·8	7·8
19 ..	5·2	5·1	4·6	4·8	5·1	5·4	4·6	4·6	4·7	4·1	4·5	4·1	4·1
20 ..	7·4	7·4	6·7	7	7·5	7·6	7·5	7·2	7·5	7·4	6·9	6·5	6·8

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HOUSE RATS OF NEPAL.

TABLE II.—*Skulls: proportional measurements.*

Dimension.	*Rattus. r. arboreus.* Nepal Terai.	*R. r. brunneusculus.* Central Nepal.		"Intermediate" Changoo.	*R. r. brunneus.* Central Nepal.		*R. rattoides.* Central Nepal.	*R. nitidus.* Central Nepal.	
	No. of Skulls:—3	Lecto-type.	11	3	Lecto-type.	6	5	2	
1	38·3—40·5	36·7	36·4—43·6	40·3—44·9	44·2	42·2—45·2	39·1—40·9	40·1	40.7
	39·4	..	39·7	42·4	..	43·7	39·6	..	..
	100	100	100	100	100	100	100	100	100
2	104—107	106	184—108	104—106	104·5	102—107	102—106	107	107
	105·3	..	106	104·8	..	104·4	105·8	..	..
3	50·6—52·1	49·6	49·5—55·6	50·5—53·4	51·8	50—53.5	51·5—54·7	52·4	51·9
	51·5	..	52	51·9	..	51·1	53·2	..	..
4	14·3—15·9	14·2	14—16·1	14·2—14·4	14·9	14·2—15·6	14·8—17·4	15	15·5
	15	..	15·2	14·3	..	14·8	16	..	..
5	41·2—43·3	41·4	37.4—44.9	37—40	40·3	36·8—40·3	40·1—42·8	40·9	40·8
	41·9	..	41·2	38·6	..	39	41·8	..	..
6	37—38·6	37·3	31—38·5	32·1—35	35·5	32·6—35·8	34·3—36·5	36·7	36·1
	37·9	..	35·3	33·3	..	34.25	35·2	..	..
7	30·1—34·5	33·5	24·1—34.6	29—30	30·7	26.8—33.6	29·2—32·2	32·9	33·7
	32	..	28.5	29·5	..	29.9	30·6	..	..
8	40·8—42·3	41·2	38·6—43·6	38·1—40·2	40·3	39·2—43·8	39·5—41·2	41·7	39·6
	41·3	..	40·3	39.4	..	40·5	40·1	..	..
9	24—24·6	24·5	22·7—26·2	22·7—24·1	23·5	22·1—24·7	23·7—24·4	24·5	23·6
	24·4	..	24·2	23·4	..	23·6	24·1	..	..
10	45·2—46·6	45·5	43—47·4	46·5—47·9	46·6	46·5—47·9	44·7—46·1	45·7	45·5
	45·8	..	45·3	47·1	..	47	45·4	..	..
11	26·6—27·7	26·2	25·2—28·4	25·8—28·3	26·2	26·2—27·9	26—26·9	25·5	24·3
	27	..	26·5	27	..	26·9	26·3	..	..
12	37·3—38·9	38·7	37·1—40·9	37·2—38·3	38·5	35·3—39·2	39—40	46·2	44·7
	38·2	..	39·1	37·6	..	37.8	39·6	..	..
13	11.4—12.3	11·2	10.8—12.2	10.—11·4	11·1	10—12·1	12—13	11·2	11·8
	11·8	..	11·5	10·8	..	11	12·6	..	..
14	55.5—58.5	57·2	55.8—59	56·1—57·2	57·7	55·7—57·7	54·2—56·5	58·1	58
	57·2	..	57·4	56·6	..	56·6	55·7	..	..
15	26·6—28·4	25·9	25.8—29	25·5—27·8	27·1	26·5—28·2	26·8—28·8	29·2	28·8
	27·8	..	27·1	27	..	27·3	27·7	..	..
16	18·3—21·2	19·4	18·4—20·3	18·3—18·6	19·2	18·2—20·5	17·8—20·5	20·7	19.9
	19·5	..	19·4	18·4	..	19·1	19·4	..	..
17	7·3—7·6	5·2	5·8—7·3	5.3—6	6·5	5·6—7·1	5·6—7·1	6·2	7·4
	7·4	..	6·6	5·6	..	6·3	6·1	..	..
18	19—20·3	17·7	17·8—19·8	18—18·8	17·9	17·9—19·2	18·8—20	19·5	19·2
	19·7	..	18·5	18·3	..	18·5	19·6	..	..
19	10·9—11·4	10·9	10·6—12	10·7—11·4	11·8	10·9—12	10·5—11·7	10·2	10·1
	11·1	..	11·2	11	..	11·5	11.2	..	..
20	16·1—17·5	18·3	17—19·6	16·5—17·4	16·7	15·9—17·5	17·6—19·1	16·2	16·7
	16·6	..	18·1	16·9	..	16·6	18·4	..	..
5	100	100	100	100	100	100	100	100	100
7	73—79.7	81	61·9—79	74·5—79·6	76·4	72·8—84	70—76	80.5	76·6
	76.3	..	69·2	76·4	..	76·8	73·1	..	..

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SCIENTIFIC RESULTS OF THE MAMMAL SURVEY.

No. XXXV.

TWO NEW RODENTS FROM THE MERGUI ARCHIPELAGO.

BY OLDFIELD THOMAS, F.R.S.

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Among the Mammals collected by Mr. C. Primrose in the Mergui Archipelago for the Bombay Natural History Society there are examples of the two following new species:—

Petaurista mergulus, sp. n.

Allied to *P. cineraceus*, Bly., but very much smaller.

Size, as gauged by skull, conspicuously less than in *cineraceus*. Colours essentially as in that animal, or at least as in the non-rufous specimens of it, for there is much variation in *cineraceus* as regard the presence or absence of rufous on the head and limbs. Back grizzled greyish brown with a slight olivaceus suffusion, the grey tips to the hairs not so conspicuous as in *cineraceus*. Undersurface greyish white, the hairs whitish with their bases more or less grey; chin and throat browner. Face greyer and less olivaceus than back. Eyes with inconspicuous blackish rings. Ears not very long, their proectote short-haired, grizzled brownish white. Posterior part of outer surfaces (metectote) with long black hairs, which extend back on to the sides of the neck, and form a conspicuous postaural black tuft. Fur on nape and across shoulders often with a rufous or fulvous tinge, but there is much variation in this respect. Upper surface of parachute washed with olivaceous. Hands and feet black. Tail grizzled hoary grey, the extreme tip inconspicuously blackish.

Skull in general shape as in *cineraceus*, but much smaller; the bullæ also disproportionally smaller.

Dimensions of the type, measured in flesh:—

Head and body 410 mm.; tail 400; hindfoot 70; ear 37.

Skull, greatest length 66·7 (in *cineraceus* 78·7); condylo-incisive length 62·2; zygomatic breadth 45; nasals 20 × 13·5; interorbital breadth 13·6; length of bulla 13·2 (in *cineraceus* 17); upper tooth series, exclusive of $p.^3$, 14·5.

Hab. Mergui Archipelago. Type and five others from Ross Island; one from Tavoy Island.

Type. Adult male. B. M. No. 22-8-21-1. Original number 243. Collected 18 November 1921 by C. Primrose. Presented by the Bombay Natural History Society. Seven specimens.

This Flying Squirrel is clearly most closely allied to the Tenasserim *P. cineraceus*, but it is so much smaller as to demand specific distinction.

Two of the seven specimens are melanoid in colour, of a glossy blackish brown.

Callosciurus epomophorus tabaudius, subsp. n.

A dark insular form of the mainland *epomophorus*, the fore-back tending towards rufous.

Size as usual in the group. Colour essentially as in *C. e. davisoni* of S. Tenasserim, but darker throughout. Epaulets well marked. Nape and fore-back strongly suffused with cinnamon, which is not redder towards

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the sides as it is in some of the subspecies. Hind-back dark olivaceous (near "olive-brown"). Undersurface about as in *davisoni*, dark grey, with a more intense median line on the chest, and dull rufous groin-patches. Ears grizzled whitish, the usual slight tuft scarcely developed. Hands and feet grizzled iron-grey. Tail darker than in other subspecies, the black rings on the hairs broader; the hairs as usual ringed with buffy basally; terminal black tuft well defined.

Dimensions of the type, measured in the flesh:—

Head and body 242 mm.; tail 215; hindfoot 50; ear 20.

Skull, condylo-incisive length 53.

Hab. Tavoy Island, Mergui Archipelago.

Type. Adult female. B. M. No. 22-8-21-2. Original number 118. Collected 21 October 1921 by C. Primrose. Presented by the Bombay Natural History Society. Five specimens.

In this island subspecies the general colour is darker than in its allies, and the suffusion of the fore-back is both more uniform, and more tending to cinnamon, that of *davisoni* being more yellowish.

Whether it occurs in other islands than Tavoy we do not yet know, but Mr. Primrose did not find it in Ross Island.

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A DESCRIPTION OF THE NESTS AND EGGS OF THE COMMON BIRDS OCCURRING IN THE PLAINS OF THE UNITED PROVINCES.

BY

E. H. N. GILL.

(*With a plate.*)

Corvus macrorhynchus (4) .. The Jungle-Crow.
Local name .. .. .. Kala-Kaowa.
Anglo-Indian name .. .. Raven.

This bird breeds commonly throughout the Province; the most favoured months being February and March. In the eastern districts (those lying east of Benares) domestic operations are commenced as a rule in January, almost all the nests having eggs between the middle and end of February. I have taken slightly incubated eggs in the first week of March, and have found young ones on several occasions by the middle of March. By the end of March and beginning of April mostly all the nests contain young, and so far as my experience goes, it has been rather the exception than the rule to find fresh eggs after these dates. In the Western districts (those lying west of Benares) the period of nidification seems to be slightly delayed, but I would not go so far as to say that this constitutes a general rule. In Allahabad, Fatehpur, Cawnpore, and Lucknow, I have taken eggs in April, mostly all in various stages of incubation. But then I have also taken eggs in the same stations in March, so that the inference to be drawn is not conclusive. However, the Eastern districts not being subjected to the winter cold of the Western districts, the period of nidification in the latter would probably have a tendency to be longer delayed.

The Jungle-Crow does not seem to favour any particular tree when choosing a site for its nursery, nor is any great importance attached to height. The topmost branches of a gigantic "Pipal" are as acceptable as the low, lean branches of some thorny acacia, or the leafy comfort of the "Mangoe". Being by nature an outrageous bully, scant attention is paid to any effort at concealment. In fact, in numerous cases it would seem as though every effort were made to render the nest as visible as possible. Both birds assist in building the nest, incubating the eggs, and rearing the young, but their powers of discrimination are as feeble as the parental instinct is strong; for I know of one particular pair which nursed a golf-ball with loving care for weeks after their eggs had been removed.

The nest externally is a crude structure of coarse sticks which serve the purpose of a substantial foundation; but internally the egg cavity is a marvel of construction for such a clumsy bird. Beautifully cup-shaped, between 6 and 8 inches in diameter, and 4 to 5 inches in depth, and lined with fine grass-roots, and vegetable fibres, over which is placed a soft cushion of horse-hair carefully fashioned to the internal shape of the nest. From below all that is generally visible of the sitting bird are the tips of the bill and tail.

I have never found more than three eggs in a nest, which I consider is the maximum number laid. So far as coloration is concerned the variation is not considerable, except that the ground-colour in some specimens may be of a richer or lighter shade than in others, and the markings in some much darker, and more irregular than in others. The ground-colour of a normal specimen is what might be described as a greenish-blue with little or no gloss, more or less blotched and streaked with different shades of yellowish-brown. In shape they are typically long ovals, distinctly pointed towards one end, but in size they vary considerably, even in regard to the eggs of one clutch. A normal egg would measure about 1·75 by 1·2 inch.

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Corvus splendens (7) .. .. The Indian House-Crow.
Local name .. .. .. Desi-Kaowa.
Anglo-Indian name .. .. Common Crow.

This species breeds, if anything, even more commonly than *C. macrorhynchus;* but at a much later period in the Eastern and Western districts alike. June, July, and August seem to be the most favoured months, though almost all the nests I have examined in August have contained young. Domestic operations, as a rule, are commenced in May, but I have no notes of ever having taken eggs in that month. A few stragglers with other interests in life do not commence building till July, but the longer they delay the more they seem to be victimised by the Koels, which commence their depredations with the advent of the rains. I have examined hundreds of nests, and have come to the conclusion that those crows which nidificate early, in the beginning of June, are comparatively free from the attentions of these parasites, and it is only the stragglers who are burdened with the work of foster parents.

This species, unlike the last, seems to prefer nesting on trees in the immediate vicinity of human dwellings; while I have noticed several instances of more than one nest on the same tree; a domestic liberty which *C. macrorhynchus* would not tolerate. The nests, though smaller, are similar in structure to those already described, except that the egg cavity is usually not constructed with such elaborate care, nor is so much discrimination exercised in the choice of materials; course rags and wool often being incorporated.

The normal number of eggs laid by this bird appears to be four, but I have taken six on more than one occasion. Departures from the normal, both as regards size and coloration, are more pronounced in this species than in the last. As a whole they are more glossy, and of a brighter blue, and the markings, though not as a rule so numerous, are in many cases much darker in colour, and more defined. Two eggs taken by me some years ago caused much speculation at the time as to their correct identification, but I was subsequently convinced as to their belonging to this species. The nest was low down on a "Nim" tree which I found to contain a single egg of pale pure blue, without spot or blemish of any kind. There was no sign of any bird, so after watching the nest for a time I departed, and the following morning discovered a second egg of exactly the same type. Still no bird in sight, but as village urchins had seen the nest as well, I considered it advisable to remove the eggs; and though the nest was obviously a crow's, I was at a loss to account for the abnormal colouring of the eggs. Subsequent visits to the nest were to no purpose, but about ten days later I was rewarded for my pains by seeing a crow in occupation. She must have been on the point of laying an egg for she hopped out at my approach and, sitting on an adjacent branch, laid her egg, which dropped to the ground and broke. I examined the shells carefully and found them to be of the same spotless blue; thus eliminating all doubts as to the correct identity of the other two. To find one such egg in a clutch would not be extraordinary, but to have all going the same way certainly provides food for thought.

In shape the eggs vary considerably; pyriform, elongated, and globular varieties being common. Typically however, they may be said to be broad ovals, a good deal pointed towards one end. The size of a normal specimen would be about 1·45 by 1·05 inch.

Dendrocitta rufa (16) .. .. The Indian Tree-Pie.
Local name .. .. .. Mootri.
Anglo-Indian name .. .. Long-tailed Jay; Oglevie.

This bird is common throughout the Province, is resident, and breeds ordinarily from April to July; though I have taken eggs in the Lucknow district as late as August. When commencing domestic operations the birds are invariably seen together, and are very noisy; and if building a nest one has only to follow them about in order to locate it. One tree seems to suit their purpose as

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well as another, but a certain amount of attention is paid to concealment, with the result that trees with large leaves, and heavy foliage are specially favoured.

The nests are rarely lower than 15 feet from the ground, and are almost invariably placed in the fork of some high branch. As a rule they are of course twigs roughly put together, more or less circular in shape, the external measurement being about 7 inches across, and in a carefully constructed nest the egg cavity would be about 5 inches in diameter, and from 3 to 4 inches in depth. As a rule however, the egg cavity is shallow, and is lined with various kinds of grass-roots, and vegetable fibres.

The eggs are of two distinct types, for which I can offer no explanation, apart from the suggestion that this peculiarity might be influenced by the age of the bird. The period of nidification does not seem to bear any significance whatsoever, for after taking careful note of the matter I have found that throughout the period of nidification the two types occur with comparative regularity; though so far as my experience goes, I have found the salmon-coloured type to be more numerous; a fact upon which I have based my suggestion of age. On the other hand I have found the two types as often in exposed and badly constructed nests as in concealed and well constructed ones, so that the theory of protective coloration would seem not to apply.

Both birds share in building the nest, incubating the eggs, and rearing the young; and are very intolerant of the presence of other species on or near their family tree; another trait which renders the nest easy of location.

In shape the eggs are typically elongated ovals, a good deal pointed towards one end, but broad ovals and globular specimens are common. The bread ovals particularly so. The variation as regards character and colouring is pretty wide but the eggs of the one clutch usually bear a close resemblence to each other. Of the two prominent types the ground-colour of one varies from a pale greenish-white to pale salmon, with markings of dark salmon and shades of purple more numerous towards the large end. The ground-colour of the other is greyish or greenish-white, with markings which vary between dark grey and light brown shades, sometimes profusely but usually thinly, scattered over the eggs more so towards the large end. Between these two types intermediate varieties varying in tone and character occur not infrequently; some specimens greatly resembling those of *Lanius lahtora*. The size of a normal specimen would be about 1·17 by 0·86 inch.

Argya earlii (104) .. .. The Striated Babbler.
Local name .. .. .. Chilchil.
Anglo-Indian name .. .. Unknown.

This species can hardly be described as being common in the Province. So far as my experience goes I have only seen it on a few occasions when touring in November over some of the grass-covered plateaux of the Vindhyas, at a point where they pass through the southern portion of the Mirzapur district, comprising part of the Benares division. Whenever I came across them they were in small parties numbering from six to a dozen. But whether they remain there to breed, or are purely winter visitors is what I was unable to ascertain. The natives of those parts are decidedly backward and unobservant, and were not able to supply me with any reliable information. In fact I very much doubt whether they were capable of differentiating between this species and *Argya caudata* which was found to be extremely common. Consequently any proferred information was not to be relied on.

According to Hume, Colonel Marshall found this species breeding in the Saharanpur district of the U. P. during the month of March and April, so that it would appear to keep to the sub-mountain tracts during the breeding season, and migrate further towards the plains during the winter. The nest is described as a deep cup-shaped structure, rather neatly made of grass without lining, and woven in with the stems if in a clump of grass, or firmly fixed in a fork if in a bush or

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low tree. The interior diameter is about 3 inches, and the depth nearly 2 inches.

I have never taken the eggs of this bird, but in shape they are described as ovals, rather thinner at one end, and of a clear, full, verditer-blue colour, measuring about 0·88 by 0·7 inch.

Argya caudata (105) .. .. The Common Babbler.
Local name .. .. .. Chilchil.
Anglo-Indian name .. .. Bush-Sparrow.

This bird is very common throughout the Western districts, and particularly in the jungle covered tracts of the Jhansi division, and southern portions of the Allahabad and Mirzapur districts. In the Eastern districts they occur, but never in any large numbers. Mr. Douglas Dewar in an article to the Pioneer some time back stated, I think, that this bird did not occur in the Ghazipur district, and he doubted if it occurred at all in the Benares division. So far as my observations go, I have seen small parties of this species in May and June on Baipur Island, not far from the civil station of Ghazipur, and in June found two of their nests; while in the hilly tracts of the Mirzapur district (part of the Benares division) it is far and away the commonest bird to be seen; occurring in small parties in almost every little patch of scrub. Indeed one has only to get down at Chunar railway station (E.I.R.) to find them comparatively common in the adjoining scrub jungle.

The nest is typical, and when once seen can never be mistaken for any other. As a rule the most noticeable points are, symmetery of form, cleanliness, the extraordinary thickness of the walls, and height from the ground; while the egg cavity is as perfect a cup as can be imagined. They are constructed throughout of grass-roots, and vegetable fibres, usually unlined, but sometimes lined with fine grass stems and even horse hair; and are placed in low thorn bushes, the more thorny the better, and only occasionally in clumps of course grass. Externally a nest would measure about 7 inches across, and the egg cavity from 2 to 3 inches in diameter, and from $1\frac{1}{2}$ to $2\frac{1}{2}$ inches in depth.

The period of nidification is much prolonged, March to September, some stragglers even extending domestic operations into October and November. The bulk seem to have eggs in March, April, and May, the young ones being fully fledged by the end of June. The popular idea seems to be that there are two, and even three broods a year, but I have not been able to accumulate any evidence to justify this theory; in fact I am inclined to believe that there is not much ground for arriving at this conclusion.

The eggs in shape are typically moderately elongated ovals, slightly compressed towards one end, but globular, and pyriform varieties are not uncommon. The shells are usually brilliantly glosy and of a delicate, spotless, pale blue colour, a shade which varies very little indeed. A normal egg would measure about 0.82 by 0.64 inch.

Argya malcolmi (107) .. .. The large Grey Babbler.
Local name .. .. .. Gangai, Sat-bhai.
Anglo-Indian name .. .. Long-tailed Magpie.

This bird is comparatively common, and breeds throughout the Province in suitable localities. Here again the period of nidification is much prolonged, from about March to October, though nests are often found in December and January. The theory of two and three broods in the year seems to be applied generally to this species as well, but it would be difficult to substantiate this with reliable evidence. In the next species I have propounded a theory, or rather made a suggestion, which might be worth the consideration of any one sufficiently interested.

Like *Crateropus canorus*, this species associate together in small parties even when breeding, a departure from the general custom obtaining amongst gregarious birds in regard to nidification, but where the former frequent gardens and groves, the present species are found more frequently in open spaces quite re-

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Nest and Eggs of the Jungle Babbler.

Nest and Eggs of the Jungle Crow.

Nest of the Rufous-bellied Babbler.

NESTS AND EGGS OF THE COMMON BIRDS, UNITED PROVINCES.

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moved from human habitations. Nests are commonly found in thin scrub jungle, and especially on babool trees scattered about open plains. In fact I have never taken nests which were not on babool trees or thorny bushes. They are never placed at any great height from the ground, and are constructed almost entirely of dry grass-roots, and vegetable fibres ; in numerous instances the outer layers being composed of thorny twigs, like the nests of *Lanius lahtora*. The egg cavity, which is more or less cup-shaped, is lined with close-woven roots of "khus-khus" grass, and similar vegetable fibres. Externally the nest would measure about 6 inches in diameter, and the egg cavity from 3 to 4 inches in diameter, and from 2 to 3 inches in depth. As a rule the nest is fairly substantial, but is not to be compared for compactness with that of *A. caudata*.

The normal number of eggs laid appears to be four. In shape they are typically rather broad ovals, somewhat pointed towards one end, but more or less elongated and spherical varieties occur sometimes. They are of a bright greenish-blue colour throughout, darker in some specimens than in others, with a decided gloss. A normal specimen would measure about 0.99 by 0.77 inch.

Crateropus canorus (10) .. The Jungle Babbler.
Local names .. .. .. Sat-bhai.
Anglo-Indian name .. .. The Common Magpie.

I should say that this bird without exception is the commonest in almost every district of the Province. Every compound and garden is frequented by them in large or small parties. In Ghazipur they are so numerous and aggressive, inflicting considerable damage in both flower and vegetable gardens, that they might very well be classified as vermin. The period of nidification is somewhat prolonged, from March to August, though I have frequently found nests in September.

The associating together of small parties even when nesting is specially noticeable in this species ; but in all my experience I have never met with more than one nest at a time in the vicinity frequented by any one party. The young when fledged immediately swell the numbers of that party, but what seems most extraordinary is that it is not till the parents of one brood are busy feeding the fledglings that another pair take it into their heads to commence building. The birds certainly do not assist in feeding the brood from another nest, so that their parential instinct would seem to be stirred only by the sight of young birds in their midst. I have noticed this peculiarity in several instances, and if it constitutes a general practice, it would explain the long period of nidification, and disprove the existing idea of two and three broods a year.

The nest resembles very much that of *A. malcolmi* but is generally not so substantially constructed, nor as neatly put together ; and is more often than not to be found in groves and gardens adjoining human dwellings. Any small tree or scrub serves the purpose equally well, but as the nest is never placed at any great distance from the ground, a considerable amount of attention is paid to concealment. Bushes and shrubbery are specially favoured.

With regard to the division of labour the greater portion seems to be borne by the hen bird ; but the cock is invariably in attendance, if for no other purpose than to cheer her with his presence, and to assist in protecting the nursery against attack.

The normal number of eggs laid appears to be four, and from a large series it would be very difficult to separate them from the eggs of *A. malcolmi*, except that taken as a whole they are somewhat smaller and of a deeper blue ; a normal specimen measuring about 0.82 by 0.64 inch.

Dumetia hyperythra (135) .. The Rufous-bellied Babbler.
Local name .. .. .. Unknown.
Anglo-Indian names .. .. Titmouse.

This bird seems to have a curious distribution in as much as it is comparatively common in some districts, and rare in others. Its skulking nature does

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not tend to bring it into prominence, so that one is apt to pass it by. I draw my conclusions, however, from the number of nests I have seen and taken.

The only districts in which I have taken eggs are Lucknow and the southern portions of Cawnpore and Mirzapur, though I have seen the birds on several occasions at Rae-Bareli, Fatehpur and Allahabad. I have never met with them in Benares and Ghazipur. The period of nidification is comparatively short, June to August, though in the Lucknow district I found the eggs most common in July, after the rains had set in well. One had only to walk along certain railway embankments to find the nests in the grass.

The nest is more or less globular, often egg-shaped, and the materials used in construction vary in regard to the position of the nest. In fact it may be regarded as a general rule that it is composed of material obtainable in the immediate vicinity. When placed in bamboo clumps it is made of bamboo leaves lined internally with fine grass roots and vegetable fibre, and if placed in grass it is almost invariably made of broad grass-blades lined with fine grasses, hair, and vegetable down.

The nest varies from 4 to 5 inches in diameter, and as a rule is well concealed, in some cases practically touching the ground, so that one has to search pretty carefully to find it. The usual complement of eggs appears to be four, though I have often taken only three. In shape they are short, broad ovals, very slightly compressed, and as a rule are characterised by irregular, smudgy, confluent zones, at the large end, of shades varying between red, and brownish-purple. The ground colour is white, pinkish-white, and bluish-white ; and the small end faintly spotted and speckled with reddish-brown. A normal specimen would measure about 0.67 by 0.53 inch.

Pyctorhis sinensis (139) .. .. .. The Yellow-eyed Babbler.
Local names .. .. Bara-podna ; Bara-piddi.
Anglo-Indian name .. .. Reed-Warbler.

This bird is to be found in most districts in the province, though I would not regard it as common. It seems to occur more abundantly in grass lands, and especially in the long, coarse grass along the banks of rivers and streams. I have noticed the birds on several occasions while out pigsticking, but I cannot claim to have taken many of their nests, and those only in the Lucknow district.

The period of nidification appears to be from the end of June to August and September, most of the nests being started after the rains have set in, and the grass is green and robust. The birds are frequently met with in gardens, while nests have been found in bushes and shrubbery. But the few nests I have seen have always been built in thick coarse grass, suspended between two or three substantial reeds, usually in the densest part.

The nest is cone-shaped, the apex being at the bottom. It is strong, solid, and compact, being composed of long strips of strong grass and vegetable fibres, tightly wound round and kept in place with cobwebs and gossamer-threads. At the top of this structure is the egg-cavity which is beautifully cup-shaped, measuring about 2½ inches in diameter, and 2 inches in depth, and lined with fine twigs and vegetable fibre closely interwoven.

The full complement of eggs appears to be five, and they are usually very beautiful to look at. Some specimens are almost bright blood-red throughout with white, or pinkish-white, ground colouring showing through here and there ; while in others the ground colouring is more conspicuous and is covered over with irregular spots, blotches, and clumsy daubs of shades ranging between brick-dust red and pale purple, intermingled sometimes with hieroglyphic streaks. In size and shape they vary a good deal, but are typically very broad ovals, obtuse at the small end ; and a normal specimen would measure about 0.73 by 0.59".

(To be continued.)

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SHIKAR NEAR AND AROUND POONA.

BY

MAJOR W. B. TREVENEN.

In commencing this article I would first of all warn all readers who have shot in such favoured parts as are to be found in Sind, parts of the United Provinces, Central Provinces and other districts, and who are accustomed to bring home bags of 100 head or more a day, that if they expect the same in this district and are not content with much smaller results, they had better read no further.

During a period of nearly five years, during which time I have shot here regularly throughout each season, I have come to the conclusion that if a bag of 20 head per gun is obtained, such days may be considered good. The two best days I have had, were 69 and 73 head, the first occasion being in the cold weather of 1919-20 with two guns, and the second in the last cold weather with three guns, one gun however being only responsible for 7 head !

On both the above occasions the bag chiefly consisted of duck and snipe.

To my mind, one of the chief charms of small game shooting in this district is the variety of species of game to be met with, although their numbers may not compare favourably with other places. This is a fact which should appeal to the sportsman who is also a naturalist. As an instance, there are ten different kinds of Quail which it is possible to obtain. Eight of these varieties I have actually shot, but two of them, the Painted Bush Quail (*Microperdix erythrorhyncus*), and the Eastern Painted Bush Quail (*Microperdix blewitti*) I have not succeeded in bringing to bag as yet although I must have tramped nearly 500 miles in search of them. As however 'Hume and Marshall' and Finn both state that the former has been shot near Poona, and it is possible that the latter might also rarely occur, I include them both in the list of "possibles." During the time I have been in Poona, I have shot fourteen varieties of duck and teal. Also in the cold weather of 1918-19 one goose, the Dwarf Goose (*Anser erythropus*) which bird is rarely met with even in other parts of India. Hume and Marshall only record the occurrence of 9 birds. I have also seen both the Comb Duck, or Nukta (*S. melanonotus*), and the Bar-headed Goose (*A. indicus*), but have not succeeded in shooting either of them in these parts. One of the latter I saw only a very short time ago in company with two Brahminies (*C. rutila*). I spent nearly three hours trying to get within range but eventually all three birds settled on an island where it was absolutely impossible to reach them without a boat. The Goose appeared to be by far the most confiding of the three, the Brahminies in each case giving the alarm.

The usual varieties of Snipe, Pin-tail, Fan-tail and Jack are all fairly common. As a rule the first to arrive in these parts is the Pin-tail which predominates in numbers at the commencement of the season, whilst towards the end of the cold weather a greater number of Fan-tail generally appears in the bag.

This season however has been an exception in this respect as regards the first arrivals, most of the snipe shot up to the middle of November being Fan-tails. This may possibly be accounted for by the fact that birds were unusually late this year, and that possibly the majority of the first detachment from the East may have halted on their way owing to the super-abundance of water this season, and that the Northern contingent (Fan-tail) which usually arrive here later, were the actual first arrivals.

It is a curious fact that although the present season is abnormally late and birds hitherto very scarce and only now coming in in any numbers (November 10th), yet both in the case of snipe and duck, I got my first bird earlier than in former years, the first snipe coming to bag on September 22nd and the first

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duck on October 1st as compared with September 27th and October 2nd, which were the earliest dates these birds had been shot by me previously.

I have heard that snipe have been shot here on September 15th but have never been able to verify this.

Another bird which is occasionally seen in large numbers is the 'demoiselle crane,' or 'kocnj.' I have only twice seen any of these brought to bag in this district, once with a rifle at Yewat Tank on the Sholapur Road and once on the river Bhima below Koregaon. On three other occasions I have noticed a large flock of these birds circling round over Khadakwasla Lake, but only saw them settle there once, when, after a very short time, they all moved off again without giving a chance of a shot.

As regards "dry" game I have already referred to Quail. Partridge, both grey and painted species, are fairly common. The Black Partridge, of course, is not found so far south. The Common Sand Grouse (*Pterocles exustus*) are numerous in places and I have also shot the Painted Sand Grouse (*Pterocles indicus*) occasionally. The usual hare or two is generally to be found in the bag after a day's shot. Florican are said to be occasionally seen and last season I heard of three Greater Bustard being shot, but did not see them personally. The common blue pigeon is plentiful in parts. In one place in particular, within fifteen miles of Poona, where there is a collection of old disused wells, I have several times had a most enjoyable hour or so, four to six birds coming out of each well as soon as a stone was thrown in, and affording excellent practice.

Green pigeon (*Crocopus chlorogaster*) are fairly well distributed over the district and quite decent bags could be made by two or three guns when the Pipal trees are bearing fruit. There are several good spots for these birds on the Poona-Satara Road and also on the Poona-Paud Road.

Peacock are fairly common, but, before killing any of these birds, it is always advisable to make enquiries first as to whether the villagers object, or not. Do not believe your shikari in this respect (he will always tell you "hukum hai"), but find out from some of the actual inhabitants.

As a general rule, one is usually fairly safe in shooting these birds so long as there is no temple or village close at hand, and they always form a welcome and substantial addition to the pot!

The Shikaris in Poona are a poor lot. Very few of them have the remotest idea of shikar, or of making any bandobast. The only use I find for them, as a rule, is to act as interpreter if one does not happen to know the language of the district (Marathi), or to send them on overnight, or the day before, to fix up arrangements for coolies, etc., if an early start the next morning is intended.

The pay shikaris demand in these parts, about Rs. 20 per mensem is far more than they are worth. I always make it a rule to give only Rs. 15 or Rs. 16 with a bonus on the number of head shot varying according to the species, which generally brings the amount up to over Rs. 20 per mensem, but has the effect of making them far more energetic as every bird shot means something to them as well.

One can, of course, send a shikari out to a certain place to bring in "khabar" but even then they are not reliable and sometimes never go near the place if they think they can persuade the Sahib to the contrary.

A new comer to the station is, of course, more or less dependent on them if he is only making a short stay in the district, unless he can get a friend who knows the ropes to take him out or direct him where to go. The shikaris will only take him out to a few stock places which they probably have not been near for weeks, their only "khabar" being either pure invention or hearsay from some other shikari who has been out there with another Sahib.

My advice to the man who is going to remain any length of time in the district, is to send off at once to the Survey of India Office, Calcutta, for the

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tour 1″ to the mile Ordnance Maps of the country round Poona. (Poona is, roughly, in the centre of these four maps) and then steadily explore the country around independently. By doing this he will not only come across the well-known places, about which he will very soon find out in any case, but will also incidentally discover many a useful little spot where none or few sportsmen ever go. There is, also, much more satisfaction in discovering some little "preserve" on one's own apart from the fact that it probably has not been shot over for some considerable time.

There are many of these little places around Poona if only a little trouble is taken to find them.

An instance of this kind occurred to me only last season. I had been shooting on one of the larger well-known tanks and had noticed a lot of duck going off in one direction and appearing to settle at some spot some miles off. The following week I made up my mind to explore in this direction and after travelling some miles off the road and incidentally discovering a small tank on the way, on which there were a fair number of duck and snipe of which I took due toll, came across another small tank completely hidden from the surrounding country which was literally full of duck. It was, by then, after 1 o'clock in the afternoon, but nevertheless I managed to pick up twenty seven duck before they finally cleared off and on the way home bagged a buck from the driving seat of the car (a Ford, nothing else would have gone over the country I had to pass through). Not a bad result for one day's exploring! I went again a second time and did equally well, but on the third time found the tank bone-dry.

On my first visit the villagers told me that no Sahib had shot the place for over 3 years.

I might mention here that towards the end of December or beginning of January, when the tanks are beginning to dry up, the rivers around are well worth exploring for duck. By this time the rivers have also shrunk and a considerable amount of "feed" begins to show. There are several useful places on both the Mula-Mutha and the Bhima where a fair amount of cover is also available. It was from one of these spots that I shot the Dwarf Goose that I have alluded to above.

To work the country in the manner I suggest, a motor of sorts is indispensable (a Ford for preference) as many of these spots are well off the road and there is often only a very "kutcha" road, or a bullock track or even less. Many of the tracks on which I take my old Ford, now nearly eight years old, would be impossible even to a motor-byke, and very few other cars have sufficient clearance or are light and strong enough to stand the jolting and bumps!

So far as big game shooting is concerned, it is practically non-existent within 50 miles of Poona save for an occasional panther around some of the neighbouring hills. The shikaries will always tell you of one that has just "killed" and that he is willing to go out and make a bandobast provided he gets an advance and the price of a goat, but in 19 cases out of 20 the result is the same—the goat vanishes and no panther!

To the man, however, who is content with Black Buck or Chinkara, Poona offers many opportunities, at any rate so far as numbers are concerned. The heads of the Black Buck average very small when compared with those up-country. Anything of twenty inches or over is above the average in this district. Occasionally one comes across a head of twenty-one or twenty-two inches but anything larger than this is rare now-a-days. The largest head which I have seen from these parts was one shot by Mr. L. J. Sedgwick, I.C.S., in 1910, near Kalas, on the eastern side of Dhond. This is a remarkably fine head, and is, I believe, the record for the Deccan. The measurements from base to tip are $24\frac{7}{8}$ inches right horn, and $24\frac{5}{8}$ inches left horn. There are five complete spirals, but the spread is somewhat small for the length. I believe the buck to

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the east of Dhond average larger than those in the country on the Poona side, but this is from hearsay only.

I always consider that, in proportion, the chinkara in this District have better heads than buck. Once, when shooting from Alandi, on the M. & S. M. Railway, I saw a chink which I put down to be well over 12 inches and another, which I put up once out of a nullah a little distance of the Sholapur Road when after partridge, was, I think, nearly as large.

The biggest chink of all I have seen in these parts and which one would have been proud to have shot anywhere was one I saw off the old disused Poona-Bombay road which joins the present Bombay road somewhere about the nineteenth milestone. I spotted this chink one day when doing some exploring in the above direction and after a long and weary stalk under a mid-day sun got within a fair range and took my shot. To my delight he fell with hardly a struggle and my shikari and chokra who were watching from behind rushed up with shouts of glee to perform the necessary operations. To my disgust, however, just as they got within a few yards, the animal got up again and slowly made off in a direct line with the shikari so that I was unable to fire again. I followed as quickly as possible although he seemed to be going stronger every minute, but lost sight of him in some undulating ground and although I tracked him for a long way, eventually lost sight of his trail on some bare rocky ground and never saw him again. I went back to the spot where I had first fired but could find no trace of any blood. The bullet had evidently been high and must have either grazed his scull or one of his horns and temporarily stunned him. My remarks on this occasion had better be imagined than repeated! I should not like to say what I put down his measurements to be, but it was certainly a better head than any I had got before up-country.

Another little animal which one comes across in some of the thicker jungles in the nallahs at the foot of the hills round about Poona is the four-horned antelope, locally termed "bekri" or "bekr." The fore horns however do not seem to develop in these parts. Both the heads that I have got, whilst having comparatively good posterior horns had merely an excrescence on the scull where the fore horns should have been and these were hardly noticeable until the scull was bare.

In both cases I got these animals with a shot gun, when walking through thick jungles.

The district round Poona also offers opportunities to the fisherman. The rivers Mula, Mula-Mutha, Indrayani and Bhima all hold Mahseer which can be caught occasionally with spoon, fly spoon, or small salmon-fly. I have never seen any large Mahseer in these rivers except in the Indrayani at Dehu in the pool opposite the temple, where, of course, one cannot fish. There is no objection to fishing a certain distance below, but I have heard that the large fish prefer to remain in their own special pool and are not to be enticed therefrom. I have never fished there myself.

There is a belief among the local people that these fish, at a certain religious festival, held once a year, all proceed some twelve miles down the river to Alandi, whence after being fed with appetizing morsels, they return again to Dehu when the festival is over.

To what extent this fable is founded on fact I do not know, but I have been repeatedly assured by the inhabitants of both Dehu and Alandi that the fish do actually disappear from the former place at times and are seen at Alandi later, only to reappear shortly again at their former haunts.

As regards the river fishing round Poona, I have done very little. Sir Charles Anderson, the late Army Commander, who was a very keen fisherman, used to catch a fair number, I believe, in the rivers near Poona with a small salmon-fly or fly spoon, but I do not think the size of the fish caught would average more than somewhere between two and four pounds.

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Above the Bund at Poona there are many large fish, particularly near the far bank just opposite the lower Boat Club and also up the backwater to the south of the island about a mile above the Bund. They seem to lie in a stretch of water between a small temple on the south bank of the backwater and the point where the latter joins the main river. It was here that I saw the biggest fresh water fish that I have ever seen. He turned over in the water in the middle whilst I was fishing towards the bank. He appeared to be nearly a foot in width, and, from the hasty glance I had, seemed to be something like a "Rohu". I have never heard of any of these large fish being caught and cannot say for certain of what species they are, but I imagine they belong to the above named family. The only fish I have caught in the still water above the Bund are small species of *Wallago attu*, Tengra, *Neopterus kapirat*, and a fish which appears to be exactly similar to the English Roach.

The only place near Poona where fish of any size are to be had is in the lake at Khadakwasla, which is the Poona water supply. This lake is full of Mahseer and also holds Carnatic Carp, *Wallago attu*, *Megalops*, all of which will take a spoon.

The largest Mahseer I have taken out of this tank weighed 17½ lbs. and the largest I have actually seen caught was a fish caught by Lt.-Col. H. R. Brown, I. M. S., who fished this lake regularly a few years ago. This fish, as far as I remember, weighed 18½ lbs., but it may have been larger.

The best day I ever had on this water was on the twenty first of April 1919, the same day on which I caught my biggest fish. On this day I had six fish, one of 17½ lbs. one of 12 lbs. and four small fish weighing from 5 lbs. downwards. There are, undoubtedly, fish in this lake well over 20 lbs.

The best time is from January onwards, until the strong winds before the monsoon begin, (generally at the end of April or early in May) when the water gets muddy. The water is then always low and the best lure is a Bronze and Silver spoon from two to two and a half inches with a three inch Jardine or spiral lead. In the early part of the cold weather when the water is high I have curiously enough, found a one and a half inch spoon with a two or two and a half inch lead decidedly more effective.

All fishing is done from a boat. To use these boats it is necessary to become a member of the Royal Connaught Boat Club, Poona, to whom they belong. The fishing is all done by trolling and about forty yards of line should be let out. The boat should only be rowed just fast enough to make the spoon spin. A spoon that "wobbles" rather than spins is more effective, especially when fishing deep for large fish. The best spoon I ever had for this work was Copper and Silver, 2 inches, plain, not hogged, and on the deep rather than shallow style, and mounted with two triangles at head and tail respectively.

The spoons sold in India that I have come across nearly always seem too flat or shallow to spin well when trolling. The rod should be fairly stiff but at the same time should have plenty of "spring" in it. I had a single jointed, eleven foot, Ringal rod made by Mantons in Calcutta in 1917 for tank fishing and found this made an ideal Mahseer rod for this kind of work.

It is necessary to hold these fish very firmly at the start and to reel up quickly, otherwise, with such a length of line out, the line becomes slack and then "Goodbye" to the fish.

I was constantly missing fish in this way until I hit upon the following plan.

I generally use two rods, and formerly, as soon as I hooked a fish, my boatman used to stop rowing at once in order to reel up the other line. The boat very quickly lost way and before I could really get a tight line the fish was off. Now, on getting a run, I make my boatman keep on rowing until I am really on terms with the fish and have got a large portion of the line on the reel, and not until then do I worry about the other line. Of course there is just a chance

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that the lines might foul in this case, but it has never happened to me yet and I lose far fewer fish than formerly.

Of course when a fish takes the hook and goes off on a rush directly *away* from the boat and does not stop or turn round after a short run it would not make much difference either way, but even then it is better, I think, to keep a certain amount of way on the boat until a fair length of line has been recovered. The boat can of course be quickly stopped, or even backed, if found necessary, but to do this before the other line is reeled up, is rather asking for trouble.

As regards the particular places of the lake on which to fish, I have practically confined my attention to the large sheet of water at the north end of the lake.

Towards the evening and when the water is low, the little bay to the left of the bungalow when looking out over the lake is good. There is a spit running out near here which can be seen when the water is very low and the fish seem to lie over this, particularly in the evenings. It is necessary to be careful not to approach too close to the shore here as the water is fairly shallow and the spoon will foul the bottom. There are, however, practically no "snags," and in the case of a foul, the spoon can nearly always be recovered by backing the boat over or beyond the spot where the hook is caught.

Another good spot, especially for large fish, is in line with the two largest mango trees on the bank opposite the bungalow (the largest tree is nearest the bank). Keep these two trees more or less in line and troll backwards and forwards in the centre of the lake. When fishing here I have generally found it better to use a fairly heavy lead.

One other place where I have had good fish is between the point running out from the near bank (lying in a half left direction from the bungalow) and the opposite creek. This point can easily be recognised by the fact that there are three or four isolated Mango trees almost on the apex. The fish seem to lie from 200 to 400 yards off the point. When the wind is blowing from anywhere between north and east it is often possible to put up fish on the sheltered water in the north eastern corner of the lake close to the Bund.

There used to be an idea that it was useless to fish this lake after about 4 p. m., and also when there was any wind, but both these ideas have been proved wrong. The best time to fish is undoubtedly between 10 a. m. and 1 p. m. with little or no wind but I have been able to catch fish with quite a strong breeze so long as the water remained clear. Once it gets muddy, it is useless to try any longer. Also, I have found that the fish are often on the "go" for about a half to three quarters of an hour at sunset and I once caught a decent fish when it was nearly dark, but this is only possible when there is little or no wind and the evening is fairly warm. There are two or three good boatmen there whom I can recommend for fishing. The man who is in charge of the P. W. D. motor boat is far and away the best of them, but I have forgotten his name. The other two are Abu and Dhaku. The former of these is the better.

There is another large piece of water, Lake Whiting, at Bhatgarh, a little over 30 miles from Poona, and lying to the west of the Poona-Satara Road. There are, however, no club boats or boats for hire here, and to fish the lake it is necessary to get permission from the P. W. D. authorities for the use of a boat. I have also heard of good fish up to 7 or 8 lbs. being caught in the stream below the Bund.

There is also another large lake at Lonavla, about 40 miles from Poona on the Poona-Bombay road where I believe it is necessary to get tickets to fish, and which, I think, were obtainable at an office at the end of the Bund. So far as I remember the price of the tickets was Re. 1 per day. This lake is one of those constructed by Messrs. Tata & Company. I have never fished there, but I believe there is a difficulty sometimes about obtaining a boat.

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One lake is now under construction by the same Company in the Andhra Valley, which lies in the same direction but rather nearer to Poona. This should be a good fishing place in a few years' time.

In conclusion, as some sort of general guide as to what may be expected in the way of small game shooting in this district, I give below a list of the various species of birds I have either shot or seen during my residence in these parts. Those marked with an asterisk were all included in last year's bag, which amounted to a total of 583 head. Roughly two-thirds of these were duck and snipe, in about equal proportion. Those which I have only seen are marked with an †

		Scientific Name.
	Geese.	
1.	Bar-headed Goose†	Anser indicus.
2.	Dwarf Goose	Anser erythropus.
	Duck.	
3.	Mallard*	Anas boscas.
4.	Spot bill*	Anas pœcilorhyncha.
5.	Common Pochard*	Nyroca ferina.
6.	Tufted Pochard*	Fuligula fuligula.
7.	Red Crested Pochard*	Nyroca rufina.
8.	White-eye Pochard*	Nyroca baeri.
9.	Gadwall*	Chaulelasmus streperus.
10.	Pin tail*	Dafila acuta.
11.	Wigeon*	Mareca penelope.
12.	Brahminy*	Casarca rutila.
13.	Shoveller*	Spatula clypeata.
14.	Nukta or Comb Duck†	Sarcidiornis melanonotus.
	Teal.	
15.	Common Teal*	Nettion crecca.
16.	Blue Wing Teal*	Querquedula circia.
17.	Lesser Whistling Teal	Dendrocycna javanica.
	Quail.	
18.	Rain Quail*	Coturnix coromandelicus.
19.	Grey Quail*	Coturnix communis.
20.	Rock Bush Quail*	Perdicula argoonda.
21.	Jungle Bush Quail*	Perdicula asiatica.
22.	Bustard Quail*	Turnix pugnax.
23.	Indian Button Quail	Turnix tanki.
24.	Little Button Quail*	Turnix dussumieri.
25.	Blue Breasted Quail	Excalfactoria chinensis.
	Miscellaneous.	
26.	Grey Partridge*	Francolinus pondicerianus.
27.	Painted Partridge*	Francolinus pictus.
28.	Pin Tail Snipe*	Gallinago stenura.
29.	Fan Tail Snipe*	Gallinago cœlestis.
30.	Jack Snipe*	Gallinago gallinula.
31.	Painted Snipe*	Rostratula capensis.
32.	Blue Pigeon*	Columba intermedia.
33.	Green Pigeon*	Crocopus chlorogaster.
34.	Common Sand Grouse*	Pterocles exustus.
35.	Painted Sand Grouse	Pterocles indicus.
36.	Peacock*	Pavo cristatus.
37.	Demoiselle Crane*	Anthropoides virgo.
38.	Curlew	Numenius arquata.
39.	Hare*	Lepus ruficaudatus,

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NOTES ON INDIAN WAGTAILS.

BY

CLAUD B. TICEHURST, M.A., M.B.O.U., M.R.C.S.

(late Capt. R.A.M.C.)

Having for a number of years paid special attention to some of the Indian Wagtails I thought it might be of some help to others to place on record the result of my researches. That the subject is a complex one may be gathered from the writings of earlier authors and I may say at once that I have seldom tackled so difficult a subject. One may be able to determine correctly most of one's cabinet specimens but to put on paper any reliable guide which enable others to do so is a matter of extreme difficulty. When one finds that, with say the Yellow-headed Wagtails, one has the two sexes differing in plumage in winter and summer, and the birds taking two years to become fully adult one may begin to realise the complexity of the task which confronts one. Thus there may be eight or ten specimens of the same species before one and not one alike! and all more or less similar to eight or ten more of a closely allied form, not to mention the possibility of *individual* variations.

To try and differentiate these in their various plumages and to tell others how to do so has been my aim and it is mainly the very carefully collected series obtained by myself and Mr. Whistler which had enabled me, I hope, to evolve a certain amount of order out of chaos.

I.—THE YELLOW-HEADED WAGTAILS.

Motacilla c. citreola and *Motacilla c. calcarata.*

In the *Fauna of British India* vol. ii p. 299, it is stated that *M. citreola* (=*calcarata*) can be differentiated from other Wagtails by the longer tarsus. I do not think these two Wagtails can be confused with any other at any season or age, the broad yellow supercilium and more or less yellow on the forehead being sufficient distinction. Moreover the statement about the length of the tarsus is not correct except for *calcarata* which certainly has a longer tarsus, for I find that out of 9 adult males of *melanogriseus* (feldeggi *F.B.I.*) and out of 10 *beema*, 8 of each are within the limits of measurement of the tarsus of *citreola*, viz., 23-25·5 mm.

Summer Plumage, males.

The males can always be differentiated. In the *calcarata* the back is black and the edges of the wing coverts tinged with yellow, in *citreola* the back is grey with a black neck collar and the edges of the coverts white. One may find birds of both species in breeding dress which are not quite the same as adults and those are most certainly birds of the previous year. In such specimens of *calcarata* the black of the back is mixed with dark grey and in *citreola* there is only a trace of the black collar and the yellow of the head is much sullied on the crown with dark feathers but in no state of plumage has *citreola* any black feathers on the back.

Calcarata : *Winter Plumage, males:*

Calcarata is darker on the back than *citreola* and lacks the black collar which perfectly adult *citreola* generally shows, while the back frequently has blackish feathers intermixed which *citreola* lacks. Occasionally the blackish feathers on *calcarata* are near the nape of the neck and so do form an indistinct collar but if so there are generally some black feathers elsewhere on the mantle. The amount af black in the upper-parts in this species varies a good deal and those with most ore adults and those with little or none, and whose backs are grey brown and

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whose under-parts are less yellow, are birds of the year. These latter are rather like some first winter *citreola* but size will always differentiate. Another small difference between *citreola* and *calcarata* is that in the latter the under tail coverts are more strongly tinged with yellow, these parts being nearly white in *citreola*.

Citreola : *Adult Winter, males.*

These differ but little from adults in summer plumage ; the head is usually less pure yellow, more sullied with dark feathers on the crown, and the black collar rather less well marked ; one finds many birds which are certainly not birds of the year and which differ considerably however from perfect adults. These are probably birds a year old. They differ from the adults in having the yellow on the head confined to the forehead and a broad supercilium running from the base of the bill to beyond the ear-coverts, the rest of the head being brown or olive brown tinged with yellow. There is no black neck band or collar and the ear coverts are sullied yellow instead of pure ; the upper-parts are more tinged with brown but the under-parts are yellow as in the adult. These birds probably become perfect adults at the next spring moult.

First winter plumage, both sexes, and *adult females.*

These are distinguishable at once from adults and one year old birds in having the under-parts *whitish* except that the chin and throat are *always* and the middle of the belly *sometimes* tinged pale yellow. On the upper parts they are browner, less grey and the only yellow on the head is confined to the supercilium which runs forward to the base of the bill on each side and is never absent. The cheeks and ear-coverts vary a good deal but are more or less dusky, *always* tinged with yellow ; in some there is a pectoral band of black spots. The yellow supercilium and tinge of yellow in the ear-coverts together with the lack of greenish tint on the upper-parts at once distinguish it from any Blue-headed Wagtail. So far as I can judge, in this plumage males and females are not distinguishable, and vary so much *inter se* that I cannot see any reliable guide to distinguish them from adult females.

Calcarata ; *Females in summer plumage.*

In this plumage two forms are found ; one, the adult, has bright canary yellow under-parts, supercilia and a tinge on the forehead (much as in winter) and the other, which is the first summer plumage is distinguishable from it at a glance by these yellow parts being very pale or whitish tinged with yellow (rather as in first winter). This was indicated by Whitehead (Ibis 1909 p. 242) and can be clearly seen in his specimens in the British Museum. From *citreola* adult it is distinguished by the greater size, blacker upper tail coverts and, whereas adult *calcarata* is as rich a yellow as adult *citreola*, the first summer *calcarata* is less yellow than any *citreola*.

Citreola : *Females in summer plumage.*

In the "*Fauna of British India*" it is said that the males and females are similar ; this is not so. The adult female has neither the pure grey back nor the black collar of the male ; the upper-parts are greyish brown, the forehead, supercilia and a good deal of the ear-coverts are yellow, the under-parts are as yellow as in the male . As in *calcarata* so in this bird, the adult plumage is not acquired in the first spring and the first summer birds are distinguished from the adults by the less bright yellow coloration of the plumage, a yellowish olive brown crown, darker, less yellow, ear-coverts.

Calcarata : *Females in winter.*

The *adult female* differs from any male in winter in lacking the yellow forehead, (the yellow on this part being confined to the base of the bill where the two supercilia coalesce) so that the whole head is dark olive with a yellow tinge instead of a yellow forehead and dark olive crown ; the lores, cheeks, ear-coverts are olive tinged with yellow instead of yellow ; there are no blackish

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feathers on the upper-parts, the under-parts are as yellow as in the male, but the intensity varies in both sexes.

The adult female differs from adult female *citreola* in having much brighter yellow under-parts (merely tinged with yellow in *citreola*) a brighter yellow supercilium, and rather darker upper-parts and ear-coverts.

The *female of the year* differs from the adult female *in lacking almost all yellow on the under parts*, these being nearly white, the supercilium and feathers at the base of the bill are sullied white instead of yellow; head and upper-parts dark slate grey instead of olivaceous brown. The lack of any yellow at once distinguishes it from any male. In this dress it is very like the young of the year of *melanogriseus*, in fact except for the larger supercilia *which meet over the base of the bill* I can see no difference except for the size of the tarsi, toes and claws. The *white* supercilia and usually the lack of any yellow on under-parts help to distinguish it from first year *citreola* of either sex. Females differ in size from males only in the length of the wing and tail which average smaller: wings 77-81 tails, 75-78 m.m.

Juvenile or nestling plumage.

Upper-parts rich brown; buffish supercilia surmounted by a broad, nearly black line, underparts strongly tinged with buffish brown, whitish on vent and throat, with a black moustachial line running down each side to the black spotted pectoral band; *calcarata* and *citreola* are probably indistinguishable in this dress except that (in those examined) the white edges to the wing coverts are broader in *calcarata*.

The *spring moult* of *citreola* and *calcarata* is the same as that given for *melanogriseus*; it starts towards the end of February and males are in full plumage about the middle of March, females somewhat later.

I have already stated that the tarsus in *calcarata* is longer than in the other Wagtails and I find that the middle toe and claw as well as the hind claw are also longer; in fact *calcarata* is altogether a larger bird with a slightly longer bill, tail and wing. Compared with *citreola* the bill is nearly always 1 to 2 mm. longer (and this difference is more apparent to the eye than measurements indicate) and though the measurements of wings and tail overlap *calcarata* averages larger in both measurements. Compared with *beema* and *melanogriseus*, *calcarata* is absolutely longer in all measurements (bill, tarsus, tail, and wing; extremes may just meet).

	M. calcarata.	*M. citreola.*	*M. melanogriseus.*	*M. beema.*	*M. calcarata.*
Wing	12 ♂ ♂ 83·5–88 once 81	12 ♂ ♂ 81–86	19 ♂ ♂ 79·5–84·5 once 85·5	12 ♂ ♂ 78–83	from orig. descr. *Asiatic Researches.— xix.*
Tarsus	27-28·25 once 26	23-25·5 once 26·5	22·5–24 once 25	22·5–24·5	1.19 inch.= 30mm.
Mid toe & claw ..	22–24 once 21·5	20–22	as in *citreola*	as in *citreola*	·62 mid toe= 16mm. claw say 7mm.=23
Total ..	48·75–51·5 once 53	43–47	as in *citreola*	as in *citreola*	

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	M. calcarata	*M. citreola.*	*M. melano-griseus.*	*M. beema.*	*M. calcarata.*
Bill exposed ..	13–14·5	11·25–12·5	as in *citreola*	as in *citreola*	·62=16mm.
Tail	74–81·5 once 84	72–77	67–76	70·5–73·5	
Hind claw ..	12·15·5 once 11	10–12 once 13	as in *citreola*	as in *citreola*	44=11mm.

The name *calcarata* of Hodgson for one of the Yellow-headed Wagtails has been dropped as it was considered that, as Hodgson described a winter bird, it could not be said which of the two Wagtails he had before him and therefore Gould's later name *citreoloides** was substituted and used in the Fauna and other works. But a careful examination of Hodgson's original description reveals that his *calcarata must* have been *citreoloides* and not *citreola*; not only does of course the name itself suggest that he had before him a bird with an outstandingly long hind claw but his measurements at once reveal that they could not apply to *citreola*. His bird with a tarsus of 1·19 (=30mm.) could only be *citreoloides*. One does not know how he measured the bill so this measurement is of little account. His measurement of the hind claw is short and I find that this measurement varies according to the time of the year. In autumn and early winter the hind claw is longer as a rule than in spring and summer in all Wagtails, this is due to wear or breaking off of the very slender tip and in such examples of *citreoloides* the hind claw often measures about 12mm. whereas autumn birds have the hind claw about 15mm.

The measurement of the tarsus and middle toe with claw is not a very easy one to take and no doubt different people would get different results on the same specimens according to where they considered the tarso-phalangeal joint to be (not always easy to see in a dry skin), but with care this measurement can be done with accuracy. Measurement from the tuberosity of the tarsus on its outer side to the tarso-phalangeal joint will give the longest possible tarsal measurement, from this last (marked) point measure to the tip of the middle claw with the toe well extended. Though these two measurements may differ according to different observers, the sum of the two measurements should correspond, and it will be seen from the table given that in *citreola* the sum of the two varies from 43–47 and in *citreoloides* from 48·75–53mm. This distinction holds for both sexes.

II.—Yellow Wagtails.

If the Yellow-headed Wagtails can be differentiated with fair certainty the same cannot always be said for the rest of the Yellow Wagtails except for the adult males; with females and more particularly with first winter birds the difficulty in many cases is to find specimens which from the locality in which they were obtained *can* only belong to one form, (for instance Yellow Wagtails obtained in Northern Scandinavia could only belong to the race *thunbergi* as no other form occurs there,) and some of these basic guides (if I may so call them) do not seem to be represented in any collection.

* *Citreoloides* of Hodgson was a *nomen nudum*.

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(*i*) *Motacilla feldegg melanogriseus* (=*feldegg* F.B.I.)

Feldegg is the western form of the Black-headed Wagtail, *melanogriseus* is the eastern. Dr. Hartert (Vog. Pal. F. 296) says this race breeds in Turkestan and winters in India and may be distinguished at first glance from *feldegg* by the white chin and moustachial streak, shorter wing and some slight differences in the colour tone of the upper and under parts. I have examined 15 adult males in spring and find the following results:

White chin present in 6, absent in 3, a trace in 6.

Moustachial streak in 3, absent in 4, a trace in 8.

Both characters are fully present in only 3 of these, entirely absent in 2, the rest have one character and a trace of the other. Now out of 24 Egyptian adult males 3 exhibit these characters of *melanogriseus* and 3 more partly so, so either both races occur in India and in Egypt, or these characters are variable; I incline to the latter view.

15 adult males *melanogriseus* measure wings (78,) 79·5–84·5 (85·5) mm.

24 adult males *feldegg* measure wings (82,) 83–87 mm.

so that *melanogriseus* is on the average a smaller bird; its wings measure mostly 80–83 whereas *feldegg* measure mostly 83–86; also I think that usually the tail is also shorter (mostly 68–72 mm.). Taking all these points I think that a sufficient percentage of specimens could be picked out to warrant recognition of the two races.

Summer plumage.

The jet black head of the male suffices to distinguish it from any other Indian Wagtail; the female has the upper-parts brownish grey lightly tinted with olive green, the head darker usually with some black feathers in it or, and these are probably older birds, the whole crown blackish, the ear-coverts and lores like the head; a few light feathers behind the eye is the only trace of a supercilium; under-parts white tinge with yellow, most pronounced on the belly and under-tail coverts and often dark spots occur in the pectoral region.

From female of *thunbergi*, the black on the head, the less richly yellow under-parts and usually less developed supercilia help to distinguish it, though some birds (? first summer) of each may be difficult. From female of *beema* easily distinguishable even in the field by darker ear-coverts and absence of a clear white supercilium, besides being less olive green on the upper-parts.

Winter plumage.

In the *adult male* the olive green back is not so bright as in summer, the under-parts a less pure bright yellow; often some dark spots on the pectoral region. Whole head is now dark slate, tinged with olive in fresh feather, with always a certain but variable amount of black feathers admixed, especially at base of bill, forehead, lores, and round eye; no supercilium. Ear-coverts dark slate or brown, with odd light feathers. Easily distinguishable from all other Wagtails except adult *thunbergi* (=*borealis*) in the field; in the hand the *black* feathers on the head distinguish it from the latter.

The *adult female* resembles the spring bird; it is rather less bright in general coloration and has no black on the head, this part being greyer; it is very similar to female *thunbergi* but is usually less richly yellow underneath and the supercilia are not so well developed; the same differences between this bird and female *beema* in spring also apply in winter plumage.

Females are smaller than males: wing 75–77·5, once 79; tail 64–72 mm.

In the first winter (*i.e.* birds of the year) both sexes lack all yellow and green tones in the plumage; this at once distinguishes them from any *citreola* and *beema*. The upper-parts including the head and ear-coverts are brownish grey or dark slatey grey, somewhat variable, darkest on the rump and the upper-tail coverts, which in males are blackish (and this is the only difference between the sexes that I can see); a well marked whitish or buffish white supercilium from base of bill to well behind the eye, but not coalescing with that of the

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opposite side over the base of the bill as in young female *calcarata*; under-parts sullied white, often a buffish wash and a few dark spots on the pectoral region. I have already drawn attention to the similarity in this dress to that of female *calcarata* in the first winter plumage.

The above description is taken from specimens which were collected in an area where *thunbergi* does not occur and checked by specimens moulting into summer plumage and so is undoubtably correct (*cf.* F.B.I. ii. p. 297).

Spring Moult. Involves the whole of the body feathers, the inner three secondaries (=tertials) all, or all except the outer two or three, of the greater coverts, all the median, all or part of the lesser coverts; the central tail always, often the whole tail, but odd feathers may not be renewed. Moults in February; by early in March males are in full plumage; females about a fortnight later.

(*ii*) *Motacilla flava beema*: *Summer plumage.*

The *males* cannot be confounded with any other Indian Wagtail. The pale french-grey head, large white supercilia, white chin and moustachial streak and pale grey ear-coverts mixed with white suffice to distinguish it in the hand as well as in the field. *The females* are also distinctive; whole of the upper-parts brown with a strong olive green wash except on the head; supercilia pronounced and white; ear-coverts like head but mixed with white; chin and throat yellowish white with a buff tinge; rest of under-parts pale yellow, much less rich than in the male. Distinguished from female *thunbergi* by the paler ear-coverts and lores and by the clear white supercilia.

Winter plumage.

The *adult males* are a dull edition of the spring birds; the under-parts less rich yellow, dark spots in the pectoral region may be present, and the grey on the head is partially masked by an olive-green wash to the tips of the feathers. From *melanogriseus* and *thunbergi* by the clear white supercilia and paler grey crown, etc. *The adult females* resemble very much the spring females and are distinguished by the same characters from the other female Wagtails.

In *first winter plumage* the sexes are not with certainty distinguishable. They are much like the adult female but usually less yellow on the under-parts. From young *melanogriseus* by the yellower belly and under-tail coverts and a certain, though variable, amount of olivaceous green on the upper-parts.

Spring moult as in *melanogriseus.*

(*iii*) *Motacilla flava thunbergi* (=*borealis* F.B.I.) *Summer plumage.*

The *male* is easily distinguishable by the dark slate grey head, absence of any supercilium (an old white feather or two behind the eye is occasionally present) and dark ear-coverts. The upper-parts vary somewhat; some specimens are dull olive green, others bright olive green, these latter also being brighter yellow underneath. This may be a question of age, and I think it is very likely, or it may be an individual variation. I am satisfied that it is not a geographical variation as both forms breed in the same district (Yenesay River).

The *female* exhibits two types differing from each other in the intensity of the yellow of the under parts. This is probably due to age (as with the Yellow-headed Wagtails), those which are brighter yellow being adults and those which are duller being birds of the first summer. The head and upper-parts are dark olive brown, greenish olive on the rump, dark ear-coverts and lores, a weakly-marked whitish supercilium is present; the pectoral region with or without spots.

Winter plumage.

The *adult male* resembles the spring male but the slatey-blue head is more or less marked by olive edges to tips of the feathers, the under-parts are less bright yellow and the mantle is more olive-brown, not so olive-green.

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The *adult female* resembles in all essentials what I have characterised as the adult summer female; the pectoral region may or may not have blackish spots.

The *first winter plumage.* I can give no distinguishing characters in this plumage as I have seen no specimens which for a certainty belong to this race.

(*iv*) *Motacilla flava simillima* (=*flava* F.B.I.)

The *adult male* in spring closely resembles that of *thunbergi* except that there is a well marked white supercilium behind the eye and more constantly has blackish spots on the pectoral region. It is doubtful whether the females and first year birds can be differentiated from *thunbergi*. The darker crown and ear-coverts distinguish it from the true *flava* of Europe with which it was confounded in the Fauna. A winter visitor to the eastern parts of the Empire.

(*v*) *Motacilla flava leucocephala.*

Spring males are distinguishable from any other Wagtail by the almost pure white crown and ear coverts,—even in the field. Females and winter birds I have not seen.

III.—The Black and White Wagtails.

(*i*) *Motacilla alba dukhunensis.*

This is the common White Wagtail of a large part of the Indian Plains in winter and is rather a poorly differentiated form of the European White Wagtail (*M. a. alba.*) The spring birds and adult males in winter are a shade paler grey on the upper parts, usually the white edges to the coverts are wider so that the two wing bars coalesce to form a broad band as in *personata*, and the wings are a trifle longer on the average than in the typical *alba*. The first winter birds and adult females in winter cannot with certainty be differentiated; some are a shade paler on the upper parts and some are not; the wing bars do not coalesce but some have rather wider white edges to coverts than is found in *alba*; on the other hand many others are indistinguishable in this respect; they average longer in the wing and, so far as I have seen, never shew the yellowish tinge on the white of the face which is often, but not always, found in *alba* in similar dress; moreover they have often more distinctly white foreheads. There is no single character however which will invariably separate them. It is possible of course that these birds which cannot be differentiated *are* the typical *alba*; on the other hand I have not seen any adult male which could certainly be referred to the latter race.

Summer Plumage.

Males and females when fully adult are not with certainty distinguishable; some females however have the white forehead less pure, ticked with black or grey, and less white in the wing coverts, these very likely are first summer birds. Sometimes females have a certain amount of white on the chin and throat but this is an individual variation.

Winter Plumage.

The *adult male* resembles the summer male, except of course for the white, not black, chin and throat, and the black crown is sullied posteriorly with dark grey; *the adult female* has the crown grey, sometimes with a few black feathers and the forehead white, but less broad and less pure than the male.

The males in first winter have the crown dark, a mixture of black and dark grey, very variable, and the forehead white, some are entirely grey on the crown and the forehead greyish, these latter resemble the first year female and are not to be differentiated; in both sexes the wing bar is double.

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Measurements.

M. alba. alba. Norway, Sweden and W. Europe	(20♂♂)	wing	88–92·5 mm.
	(11♀♀)	,,	84–88·5 ,,
M. alba dukhunensis. Sind and Punjab	(21♂♂)	,,	91–96 ,,
	(7♀♀)	,,	84–91 ,,
M. alba dukhunensis Yenesay (breeding)	(17♂♂)	,,	91–96 ,,

Dukhunensis is distinguished at all seasons and in both sexes from *personata* by the white, not the black, ear-coverts; in winter also by the white throat, and always by the shorter tail.

dukhunensis tail (82,84) 88–95 mm.
personata tail (87,90) 93–102 mm.

Spring moult involves body, always the central tail and fairly often other tail feathers; inner greater coverts, usually the three tertials, all the median and some of the lesser coverts.

(*ii*) *Motacilla alba personata.*

Summer plumage. Both sexes have white foreheads and black crowns and ear-coverts, also chin and throat. The black on the head in the female rather less wide than in the male, that is to say it extends not so far down on the nape, otherwise the sexes are similar. Males differ from males of *hodgsoni* in having grey, not black, lesser wing coverts and mantles; some females almost indistinguishable from females of *hodgsoni* but in the latter the mantle and lesser coverts are usually grey mixed with black or almost quite black, in both sexes however *hodgsoni* has usually a longer bill and shorter tail (89–95mm.) Broad white wing band much as in *hodgsoni.*

Winter plumage. The mantle resembles the summer bird but the chin is white and the bases of the throat feathers are white so that a certain amount of white shews in this part. The female is much the same, usually the black on the head is less wide. In both the ear-coverts are black.

Males in first winter resemble adult males, sometimes, but not always, the crown is less black, *i.e.*, mixed with grey; the broad white wing band is not so pure white. The female has black ear-coverts as in the males, the head is grey, forehead white bordered posteriorly with blackish feathers; wing band as in male. Chin and throat in first year birds much as in adult; the amount of black or white on the throat varies individually.

Measurements.

6♂♂ wing 94·5–98 tail mostly 98–102 bill from base 16·5–17·5 mm.
7♀♀ wing 87·5–95 tail mostly 90–100 bill from base 15·5–17 m.m.

(*iii*) *Motacilla alba hodgsoni.*

This is perhaps the most handsome of the Black and White Wagtails; in summer plumage the male has the crown and all the upper-parts pure black, forehead white, ear-coverts, chin and throat black as in *personata.* Lesser coverts black and broad pure white wing band. The female varies somewhat, some, perhaps older birds, are as black on the upper-parts as the male, others are darker grey than *personata* mixed or not with black feathers; these are perhaps birds of the previous year.

In winter the black ear-coverts are retained and the bird is very like *personata*; however the darker grey of the mantle with or without black feathers admixed, the shorter tail and rather longer bill will differentiate it.

(*iv*) *Motacilla alba ocularis.*

Differentiated from all the other Wagtails at all seasons by a black line from the base of the bill through and carried on beyond the eyes. It has a gre mantle and white ear-coverts.

(*v*) *Motacilla alba leucopsis.*

A black-backed form like *hodgsoni* but has white ear-coverts, which at all seasons will differentiate it from the latter.

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(*vi*) *Motacilla maderaspatensis.*

Mr. Stuart Baker puts this Wagtail (B.N.H.S. 27 p. 37) as a race of *alba*; with this I cannot agree. It is possibly true that it does not breed in the area of *hodgsoni*, there being probably an altitudinal difference in habitat, though it undoubtedly does breed in the Himalayas; yet in many points this species differs from the *alba* group. Firstly this bird is in habits unlike the latter group in being practically confined to water courses. Secondly, it is resident throughout most of its range whereas all the *alba* group are migratory. Thirdly, its very superior size; fourthly, its total absence of white forehead which all races of *alba* shew in winter, fifthly the summer and winter plumages are alike and sixthly, so far as I have been able to ascertain, it has no spring moult.

IV.—The Grey Wagtail.

Motacilla cinerea melanope.

This is the Eastern representative of the European Grey Wagtail. It differs from the latter in having a shorter tail and some alleged differences in the outer three tail feathers, *viz*:—(1) outer tail feather brown on the middle of the shaft, (2) the next, some brown on the inner web and (3) the third, black on the inner web's edge. I have examined 30 specimens as regards these characters and I find the following results:

Character	(1)	Present in	23	out of	28
	(2)	,, ,,	5	,,	28
	(3)	,, ,,	15	,,	24

In only 4 out of 27 do the alleged characters hold good in all three feathers, in only one do they fail in all three. On the other hand in *M. cinerea cinerea* I find—

Character	(1)	Present in	1	out of	9
	(2)	,, ,,	1	,,	9
	(3)	,, ,,	7	,,	9

Hence it is obvious that characters (2) and (3) are useless and character (1) is of some slight help together with the length of tail in distinguishing these races.

30 specimens of *melanope* measure:—Tail 88–95, and 9 of *cinerea* 98–110 mm.

Besides a wide breeding distribution in Asia, this bird breeds in the Safed Koh, (just over the N. W. Frontier) and in the Himalayas.

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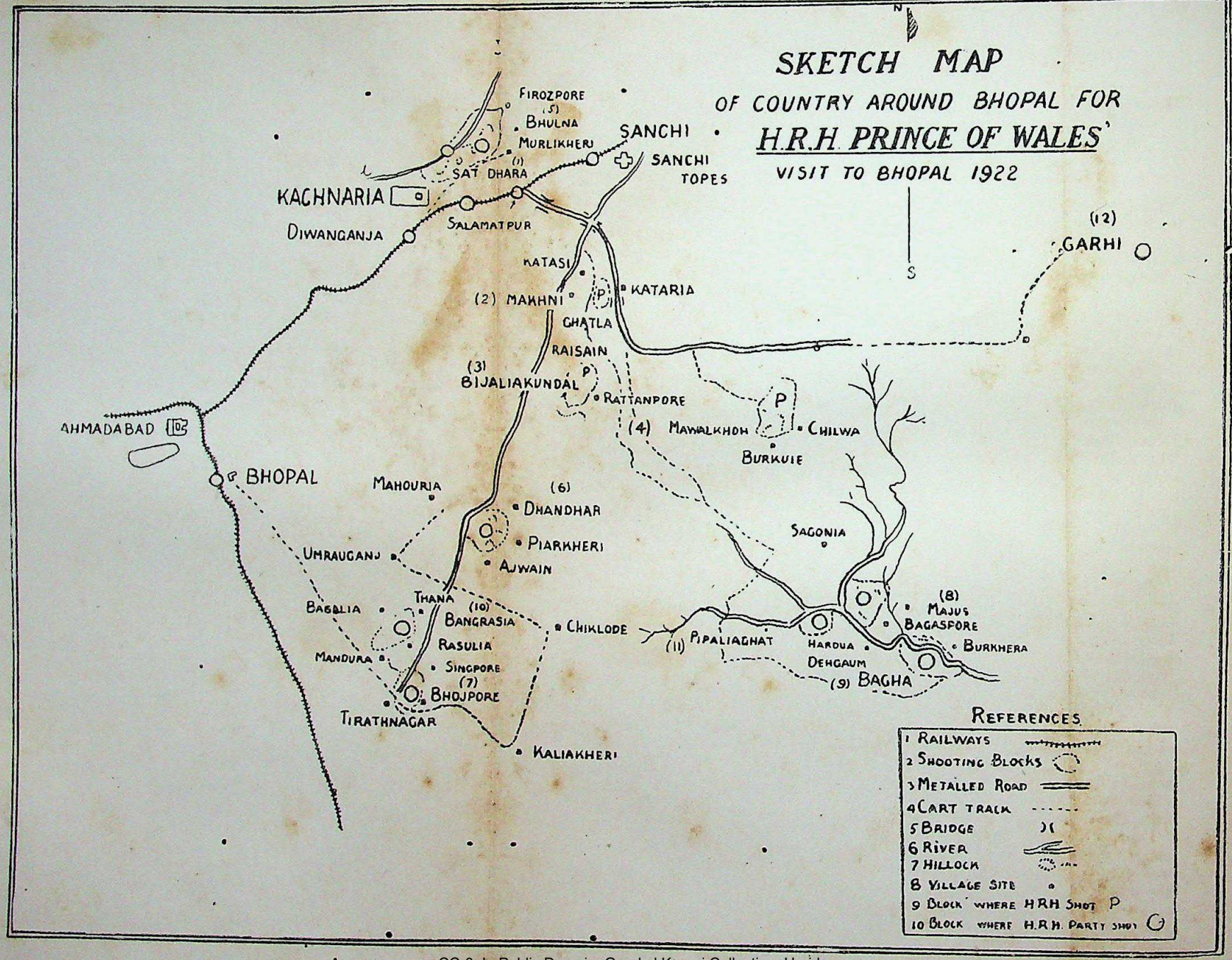

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H. R. H. THE PRINCE OF WALES' SHOOTING IN INDIA IN 1921 AND 1922.—PART II.

By

BERNARD C. ELLISON, C.M.Z.S.—(*Naturalist to the Shooting.*) F.R.G.S.

(With three plates and a map and 2 text figures.)

BHOPAL.*

The Prince arrived at Bhopal on a bracingly cold morning, February 4th, 1922. But this account is not concerned with shivering officers dressed in white, nor with red carpets, bands, banners and booming guns, but with wooded hills and glades, and the free unfettered life of a shooting camp.

Before we plunge into the jungles, a word to those to whom Bhopal is but a familiar name. Thousands are hurled into the Bhopal railway station yearly and thousands pass on, little knowing, for the sight is not for them, that a mile beyond the utilitarian rows of station buildings lies one of the most beautiful places in all India, unique, with a charm wholly its own.

Here on the northern edge of two large sheets of water rises the city, white palaces gleaming amidst green trees, while tall minarets, their glittering spikes dominating all, mark unmistakably the religion of the Ruler.

On the southern shore stands the residence of General Obeidullah Khan with its magnificient view over the lakes, and, at a lower elevation, the comfortable "Lal Kothi" in which His Royal Highness resided during the visit. This faces across the lower lake towards the group of old palaces, the grim city walls, and the Fatehgarh Fort which so stoutly withstood the Maratha hordes in the 18th century. To the west, towards Sehore, the country is level and cultivated, but to the north and east the land is full of hills which, as one gets further from the city, become rougher and covered with fine jungle, an ideal haunt for wild animals of every kind.

The intervening time from the 4th till the evening of the 5th was spent in a round of functions and amusements comprising the State visits, the Banquet, Polo, Tennis, Yachting and Shooting, all provided by the hospitable Begum of Bhopal in honour of her Royal guest. The shooting proper was to take place at Kachnaria, about 20 miles as the crow flies out of Bhopal, where had been pitched a standing camp out in the jungle.

Some sport was enjoyed round Bhopal before the party went to Kachnaria. Sir Godfrey Thomas went out from Bhopal for buck on the afternoon of the 4th February towards Duraha, but, although the country promised well, a glimpse of two Chinkara out of shot was all the reward he obtained for his exertions. Admiral Halsey who went towards Ashta also had a blank day. There had been a lot of recent traffic on these roads on account of the Prince's visit which had disturbed all buck and chinkara and made the herds go far from the main roads.

Captain Dudley North, Captain Piers Legh and Commander Newport went out after snipe and had some sport, bringing in 18½ couple. A good morning was spent with sand grouse on the Sehore Road. A nullah was found where the grouse watered and about 15 brace were got, mostly pintail.

Another party amused themselves on the lake at Bhopal with duck, which were very numerous but difficult to get at. Attempts were made to circumvent them in boats, but it was of no avail. Staying out for their evening flight was tried by another party who had good sport at the top end of the lake among the

* I am largely indebted to Colonel Luard for this article.

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reeds. About twelve couple were accounted for among which were four couple of mallard.

On the 5th of February the writer left early by special train in order to see that his men, who had arrived some days previously, were properly settled in their camp. After a railway journey of about 30 miles through thickly wooded country with plenty of small hills and crags which augured well for prospects of good shooting he arrived at Salamatpur Station and was met by Colonel Iqbal Mohamad Khan, a nephew of Her Highness the Begum, and together they rode to the camp about five miles away.

The Shooting box at Kachnaria provided for the Prince's accommodation was a magnificent white pavilion made of stone. This had been built at the shooting camp by His Royal Highness' host, the eldest son and heir of Her Highness the Begum, Nawab Sir Nasrullah Khan, himself a big game shot of high repute, who has shot over 130 tigers, mostly in Bhopal State. Some time ago the Nawab started erecting a country residence at Kachnaria, and as soon as the Prince of Wales' projected visit was announced the building was rapidly completed, electric light was installed, and water laid on. Round it a large camp was pitched, as the house was only able to accommodate the Prince and a small portion of his staff. His Royal Highness was the first inhabitant of the house and consented that it should be named the

"Prince of Wales' Farhat Manzil"
(Prince of Wales' abode of delight)

in memory of his visit.

Some distance from the house at Kachnaria a special skinning camp had been arranged. It lay in a small depression and was surrounded by trees—the "Wanton lapwing's" eternal cry of "Did you do it" shewing that it was their favourite haunt. Sheds of bamboo with leafy tops had been erected. Here every arrangement was made for dealing with the animals shot. The whole place was delightfully cool and airy and both for this reason and on account of the convenience of its situation so close to the rest of the camp was an ideal place for a skinning camp.

Profiting from his experience in Nepal the writer made arrangements for each member of the shooting party to take out labels, giving them to each person every day after dinner at the end of the day's shoot. This he found worked very well, as all confusion was thus obviated. There were generally several parties shooting and every person who secured a trophy affixed a label to the animal immediately after it was killed and saw that proper measurements were taken. Thus mistakes were impossible, measurements being taken and recorded at the time of shooting before *rigor mortis* had set in.

The arrangements at the shooting camp had been personally supervised by Sir Nasrullah who had spent weeks in accelerating the work of preparing the house and in arranging the beats.

* * *

Leaving Bhopal by special train on the evening of February 5th, the Prince and his staff reached a way-side platform erected for the purpose about 6-30 p.m., whence they were motored along fair weather roads, made for the occasion, to Kachnaria about two miles away.

A triumphal arch of green leaves had been erected at the entrance to the camp, and here the local populace had gathered to await His Royal Highness' arrival. Most of these people were Gonds, a jungle tribe which inhabits these forests. They had prepared to greet the Prince with one of their dances, and women and men were already dancing, as their custom is, in separate groups, the men in white and the women in red clothes; "tom toms," cymbals and the monotonous chant with its emphatic cæsura beat and occasional loud shouts adding to the weird scene. But alas! a practice game of polo and

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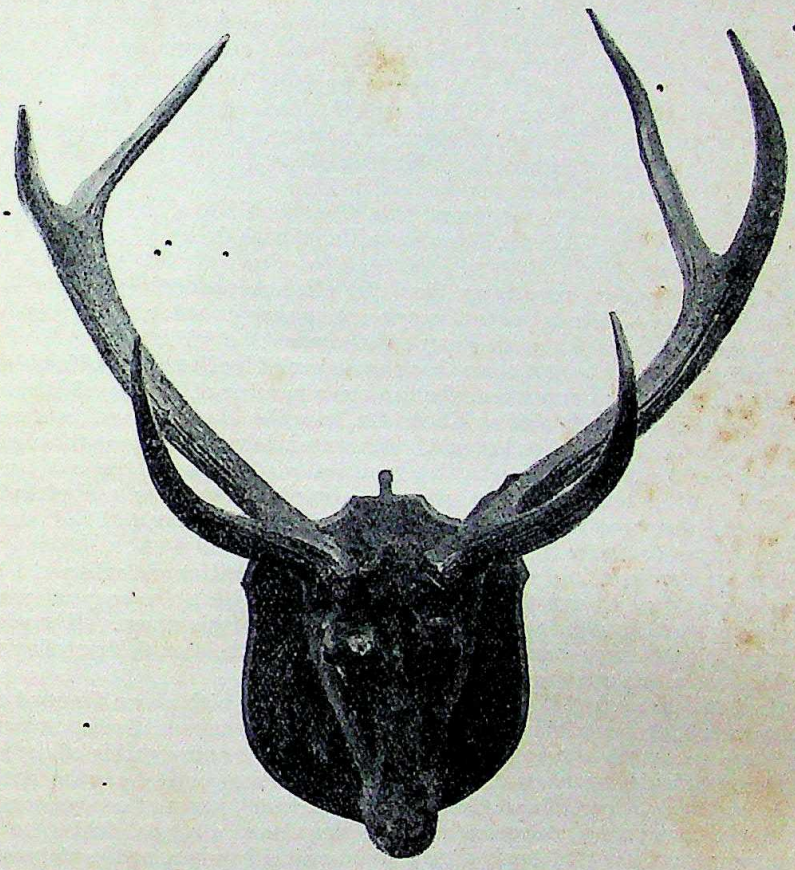
an inspection at General Obaidullah Khan's house of the record Sambhar head (50¾") shot by the General's father delayed the start and His Royal



Highness reached the camp only as darkness fell. No bustling Police car (an unnecessary precaution there) announced H. R. H.'s approach and the Prince had come and passed the arch unrecognised before it was even suspected he had passed. However on another occasion, when returning from a shoot, the Gonds had their opportunity of performing.

While the writer was at the skinning camp just before the Prince's arrival news of a "kill" some four miles away was brought in. As in Mysore, news generally came by an elaborate system of Heliographs on the surrounding hills. In the early morning from one's tent the lights could be always seen flashing in the morning sun.

To turn now to actual events. A glance at the map will show the places to which His Royal Highness went, these being marked "P," while blocks to which members of the party went are marked "O". I have already noted that some shooting was done direct from Bhopal by members of the staff, who did not come out to Kachnaria but joined the camp for the day.

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The party at Kachnaria on the night of the 5th February comprised :—

H. R. H. the Prince of Wales,
Colonel Nawab Sir Nasrullah Khan,
The Earl of Cromer,
Admiral Sir Lionel Halsey,
Colonel Worgan,
Mr. Petrie,
Commander Newport,
Lord Louis Mountbatten,
Colonel C. E. Luard, *Political Agent in Bhopal.*
Colonel McConaghy, *Agency Surgeon in Bhopal.*
Sahibzada Habibullah Khan,
Sahibzada Rafiqullah Khan,
Colonel Nawabzada Obeidullah Khan,
Lt.-Col. Nawabzada Hamidullah Khan,

and the writer.

The following diary extracts are the writer's impressions of the shooting :—

6th February.—Although several people got up early to shoot, most waited for the Prince ; and until 9 a m. the party awaited news of a " kill."

The Prince then set out on horse-back accompanied by Nawabzada Hamidullah Khan, the Begum's youngest son, who was also a member of His Royal Highness' suite, and Sahibzada Habibullah Khan. Sir Nasrullah then followed in a car in which were Colonel Luard and myself. The route led from Kachnaria to Salamatpur Station, 3 miles off, whence a fine metalled road leads to the old fort of Raisen. After travelling some distance along the road our car picked up Admiral Halsey who had been out since early in the morning and had shot a Nilgai, about two miles from the Station.

The country on either side of this road was cultivated except where the hills come close up to it, and the fields were covered with a fine crop of wheat, easily grown without irrigation on the fertile soil of this region. The wheat, though it looked very stunted to eyes accustomed to the corn-fields of England, was in fact a first rate crop.

Soon the car reached the old fort of Raisen standing high above the road on a lofty rock, 1,980 feet above sea level. Founded in early days of Hindu domination in these parts, it subsequently became one of the strongholds of the local dynasty of the Muhammadan Sultans of Malwa, whose capital was the ancient fort of Mandu, near Mhow Cantonment. Held by various competitors for power in these parts, it witnessed many a sanguinary struggle, falling to the Emperor Sher Shah (1543) only after a protracted siege when, as the picturesque account of the old historian says, its defender, a Hindu, " 'Puran Mal' and his companions, like hogs at bay, failed not to exhibit valour and gallantry, but in a twinkling of an eye, all were slain." It is now but the shell of a fort, yet its massive stone wall, pierced with nine gate-ways, and its thirteen bastions still defy the elements. But this is a digression.

At Raisen the car swung off on to a specially prepared fair-weather road through jungle country and round fearsome corners, no relaxation of speed being considered necessary by the drivers because the road was "Kacha", though possibly Mr. Nash (the car's maker) might have expostulated had he been present.

At a spot a little distance from Raisen we halted for a short time to wait for the Prince who was on horse-back some way behind. It was a most picturesque place, where a shrine and small Idgah stood in a walled enclosure surrounded by trees—the tomb of Pir Fatehullah Shah.

At the Pir's tomb we were joined by Colonel Worgan who was limping, being rather lame after a recent polo accident ; he had been out very early, but had only flushed some small game ; shortly afterwards the Prince of Wales came

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THE ROYAL PARTY CHANGING BEATS ON 6TH FEBRUARY 1922.

THE CHEETAH AT BARODA.

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riding up. We then drove on for a couple of miles and reached a place called Bijalia Kondul (3) at about 12-30. Getting out of the car we walked to the machans which were about 200 yards distant, flushing some partridge on the way. The machan in which Colonel Worgan and I were placed was not a good one except from the point of view of being nicely sheltered. It did not allow one to swing a rifle round quickly in the event of the tiger breaking cover from any direction other than that immediately in front of us. Little basket stools would have been extremely useful here.

The tree on which the machan was erected had a lot of dry leaves which made a constant cracking noise as the wind rustled through them.

The cry of the beaters began at 12-50, a not unmusical "Yoo-oo" in a pleasant intonation, punctuated now and then by the beat of a drum, and was maintained continuously up to the shooting line. Some jackals sneaked out, stood for a moment on the edge of the open space, and then crossing in haste, vanished beyond, while the pit pat on the dry leaves of many peacocks' feet was heard, followed by a whirr as a cock cleared the open space and floated down into the brushwood beyond.

The beaters' voices seemed to approach and recede, as they mounted a ridge or crossed a depression.

A quarter past one passes but no tiger. He seemed to be keeping along the hill. Suddenly two shots rang out—then silence—that pregnant silence of which the secret is known as a rule only to the shooter and often not to him. We remained quietly in our machan thinking that probably the tiger had been killed by the Prince. The heir apparent of Bhopal then came up to our machan and told us he thought the tiger was hit. We got down from the machan and learnt what really happened. Actually a tigress did come out very fast in front of H.R.H., uttered a "woof" and passed clean under the machan and out in the rear, giving very little chance of a certain shot, and fled untouched—going away equally fast. The Prince did not fire as it was not a possible shot. She was an old hand at the game and had evidently escaped her fate on many previous occasions. Three Sambhar also broke out and it was at these the shots had been fired.

After this we had lunch and then drove back towards the Raisen road to a place called Makhni (2 on the map) about eight miles away, where the second beat was arranged. At 3 o'clock the machans were reached and the beat began. At about 3-45 the beat came up. But no tiger was seen, only some bears and one male and two female Nilgai, which passed within sight of Colonel Luard, but out of range. The reason I think why the drive was blank was that we had been expected in the morning, many people had been about and their movements had driven game away. Moreover the machans, as in Mysore, were in rather too open ground and too near the out drive. Getting into the cars again we drove to the scene of the third beat which was in Makhni forest about two miles off. Two shots were fired, but nothing was hit nor did the majority of the guns see anything but a lot of langurs and some quail and pea fowl.*

So much for the fate of His Royal Highness' party. Those who were not with the Prince had better luck.

Sir Godfrey Thomas, Captain Poynder, Captain Legh, Captain Metcalfe and Mr. A. Metcalfe, under the guidance of Colonel McConaghy, went to Satdhara (1). The first beat, a very long one, produced a tiger. It was shot by Captain Poynder and was in fine coat, and had a magnificent ruff on its neck. As it lay on the ground by the tree near Captain Poynder's tent it looked a fine

* The peacock is sacred in the eyes of Hindus. In their mythology it is the steed on which the goddess Sarasvati, the Minerva of India, rides, and therefore peacock feathers are not unlucky here as they are in Europe. Peacocks are never molested in Hindu States; but in Mussalman States like Bhopal they can be shot, as long as they are not in or close to villages.

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big tiger, but on measurement did not prove to be as big as was anticipated. It measured 8'-11½" and was 1'-10" round the fore-arm.

The party then moved to a second beat at Bhulna (5). This was in the same direction and the line of machans was under a low range of wooded hills. Some sambhar crossed the ridge, but they were too far off to distinguish heads. There was a certain amount of firing and Colonel McConaghy got two sambhar. One was of a class now so often met with I am told in Bhopal jungles, with a large body and ill-developed horns. Whether this is due to overshooting resulting in the destruction of the best heads, or due to an excess of does and consequent weakening of the stock it is difficult to decide. A member of the staff writing to me describes what followed afterwards.

"Poynder had shot at a panther which galloped straight down the path towards him and wounded it, but had no idea where he hit it. It was decided to follow it up for a bit on foot and everyone was just getting on to the blood tracks when an excited man rushed up and said that the panther was sitting under a rock on the hill about 100 yards in the rear. We made a cautious approach and found several men up in trees chattering hard and pointing to a spot where we eventually with the greatest difficulty distinguished the animal. It was hard to make out how he was lying, and though obviously hit he was by no means hors-de-combat. Poynder took a shot at it which made it jump and then Legh and a shikari blazed off. Stones were then thrown and people came to the conclusion that it was dead. She proved to be a small female panther and was so knocked about as to render the skin practically useless but she was carried back in triumph by a vast crowd of beaters who suddenly appeared as if by magic from every point of the compass."

Captain Poynder described the incident himself to me as follows:—

"The panther came out right at the end and galloped straight at me down a path. I fired twice and she disappeared. We found blood and hair on the path and a cooly came in shortly afterwards saying she was badly wounded and lying down 200 yards away. We walked up and found her lying behind some rocks with only her side showing. Not knowing how badly she was hit we did not risk too close an approach and fired at this. Unfortunately both Legh, Godfrey Thomas and a shikari fired as well as myself so the animal was knocked to pieces. My original shot had gone through the off shoulder from the front, breaking the bone to atoms so we need not have been so alarmed. Again my ·470 that I eulogised to you before." The panther measured 6 feet and was a female.

Having only come out for the day from Bhopal Colonel McConaghy's party had to return in the evening by goods-train. Misinformed as to the time of its departure they were quietly motoring to Salamatpur to catch it when they saw it coming along towards them. Abandoning their car, which was close to the line, they rushed on to the track, carrying their guns, and stood four abreast across the track with their arms out. The train had either to stop or run over them and the engine driver luckily chose the former alternative. They climbed into the guard's van and the man did not seem at all surprised, as if holding up trains on the main line was a common occurrence in India.

Captain Dudley North went out for sambhar to Bhojpur (7) on this day, and thus describes his experiences to me: "On the 6th February I shot a sambhar stag 33" with my ·286 Mauser. I was sitting in a machan, which was on a high rock half way down the slope of a hill, the beaters being on the other side. A number of sambhar does passed down a track along the side of the hill, going from left to right about 100 yards from me. There was a cutting in the jungle going straight up the hill, and as each one passed I took careful aim in case a stag came along. A small stag passed and then a much larger and darker-coloured one. The light was not good but the head seemed to be good enough, and so I fired. I thought I had hit it, but it went on, and it

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was not till the beat was over that I was able to climb up and look and found it, 15 yards further on, shot right through the heart. I paced out the range which was about 110 yards."

Setting out very early in the morning of this same day, the 6th of February, the Earl of Cromer and Lord Louis Mountbatten reached Bagha at about 8 a.m. This place, marked on the map (9), is 45 miles south-east of Kachnaria and at the bottom of the map on the extreme right. A few minutes after their arrival the beat started. Four tigers came out; two were bagged by Lord Cromer and two, on hearing the shots, broke away from the line of beaters.

Sambhar and chital passed Lord Louis Mountbatten within shot, but he did not shoot at them as he was waiting for a tiger. From Bagha they motored to Majus (8) where they were joined by Commander Newport and Mr. Petrie who had gone out to Pipaliaghat but had had no luck, although immediately after the beat started a tiger was heard roaring close by. Unfortunately it did not pass the machans, and probably slipped away between the stops. No shot was fired in this Pipaliaghat beat. At Majus the beat started at about 2 p.m. A special machan was given to Lord Louis as he had had no luck at Bagha. Sambhar, chital, etc., came out. Eleven shots were fired at them by Commander Newport, Mr. Petrie and Lord Louis, but nothing fell to any body's gun.

Lord Louis Mountbatten thought that he had wounded a sambhar, so a search was made but with no result.

Among the guests at Bhopal on the Royal Visit were members of the Cavalry School at Saugor who, with Colonel P. B. Sangster, their Commandant, came to play Polo with the Prince and they shot on several occasions with members of the staff.

Admiral Halsey, Mr. Petrie, Captain Watkins and Captain Crichton motored out about 5 miles from the shooting camp and had 3 beats for sambhar. They saw plenty of sambhar, at least 30, but there was not a suitable head amongst them.

The Prince's party, with which I was, arrived back at Kachnaria about 6 p.m. Going down to the skinning camp I saw that three tigers, one panther and one Nilgai had already arrived and, after the Prince had inspected them, they were taken to the skinning camp and work on them was immediately commenced.

The panther had been very badly hit. All the entrails were coming out and the skin was practically useless.

The skinning camp was naturally looked on by the vulture community as their special meeting place. Hundreds assembled, dropping out of space to the tasty and sumptuous feast below. The King vulture (*Otogyps calvus*) with his conspicuous zone of white feathers on the breast; the long-billed brown vulture (*Gyps indicus*) with his fine white ruff; the white backed vulture (*Pseudogyps bengalensis*) with his marked white rump, the commonest of all vultures in Central India, and "Pharaoh's chicken" (*Neophron ginginianus*) with his consequential waddling walk, a familiar figure in very cantonment in India. In addition to the tigers and panther which were already in the camp, 5 sambhar were shot this day, one by Colonel O'Kineally, one by Captain Bruce Ogilvie, two by members of the Cavalry School and one by an American whose name I have forgotten.

The State band came down to camp and played at and after dinner, greatly assisting certain terpsichorean efforts of the guests while adding materially to the entertainment of all.

I had brought with me to camp two of Stuart Baker's Game Bird books, one on "Ducks and their Allies" and the other on "Snipe, Bustard, etc." These I showed to the Prince after dinner, and also to the heir-apparent of Bhopal who had quite

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recovered, after a rest, from a slight hurt he had experienced during the arduous day's shoot. They interested His Royal Highness greatly, particularly the description of Imperial Sand Grouse which he had shot only two months before in Bikanir. The Prince told me he had at Sandringham several original bird paintings, which he prized very much, by Thorburn, the famous ornithological artist.

February 7th.—The beats on this day also lay towards Raisen. Some of the party, it may be mentioned, went out at dawn but obtained nothing. As before, the way lay through jungle over kachha roads marked out with stones. The advance guard of the party had to wait for His Royal Highness who had ridden part of the way. On his arrival at Mawal-Kho (4) the party climbed up to the machans which were placed on a high ridge.

There was dead silence for a time and from my machan I could see that the beat had started numbers of langurs which came bounding through the line quite unconscious of the presence of the shooters. Two wanted to ascend my machan, but the sound of the breaking of a twig frightened them and off they scuttled.

A sambhar belled, perhaps scenting the tiger, and a small chital passed out. Four bears came out close to the Prince's machan, two being cubs which kept falling back as they tried to follow their parents up the steep cliff, an amusing spectacle.

When the beaters came out Lord Cromer and myself left our machans and went to the one on which Colonel Luard was sitting. He pointed out the risk of being below while beating was still going on over part of the line, and so we mounted up beside him. Nothing came out, although it was asserted that the tiger was there when the beat began.

On the way back some chital and a buck were seen. The Prince got out to shoot; but another car coming up frightened the buck away.

I then went back with the party to Salamatpur Station and from there motored on to the skinning camp. The Prince and staff returned to Bhopal. On the Raesin-Salamatpur road which we traversed we could see the ancient Buddhist topes of Sanchi. Colonel Luard told me, and it is interesting to recollect, that the jungle in this part was so thick during the Pindari War that the existence of these famous topes, which had stood on this hill since 300 B.C., was unknown to all but a few Gonds, and that General Taylor came upon them by accident only in 1818. The carved gateways, which can just be seen from this road, standing in front of the central tope are unique specimens of carved stone work and date from the first century A.D.

Of the other parties out this day, Captain Dudley North, Commander Newport and Lord Louis Mountbatten had been far afield to Garhi but returned at 5-30 p.m. having seen nothing at all.

Sir Godfrey Thomas, Sir Geoffrey de Montmorency, Captain the Hon'ble Piers Legh and Colonel Harvey motored out from Bhopal in a north-westerly direction to a series of beats in parallel lines along a thickly-wooded ridge. The place was called Dhandhar. There were a number of Sambhar in the beat. Sir Godfrey Thomas had a shot at one that came out opposite his machan, but hit it too high up and it had stumbled and was gone before he could get in a second shot. It passed through the next beat and Sir G. de Montmorency had a shot at it from long range, but he never saw it again, though as it happened it was picked up dead that evening after the party had left.

Sir Geoffrey de Montmorency also had success, securing a big Nilgai, and Colonel Harvey shot a pig on the same day.

The antics of a Mongoose caused them much amusement. It was running about over some rocks and was much harassed by a lot of peacocks who made a great commotion moving over the dry leaves, so much so that people thought that at least a sambhar was coming out. Sir Godfrey Thomas met with a curious incident in his machan. A fan-tailed fly-catcher (*Rhipidura albo-frontata*)

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came and fluttered about among the branches a few feet from his head and eventually perched on the end of his rifle barrel.

Two more beats resulted in nothing. This finished the shooting in Bhopal between the dates of February 4th and February 7th, 1922. The total bag in the Bhopal shoot was—

Big Game—		
Tigers ..	3	
Panthers	2	
Sambhar	12	
Nilgai ..	2	
Wild Boar	1	
Small Game—		
Snipe ..	18½	couple.
Sand Grouse	15	brace.
Duck ..	12	couple.

The bag given is not a large one, but it is only fair to all concerned to point out that in February the trees and bushes are still covered with leaves, and grass is high, which increases the difficulty of turning out animals. In addition to the difficulties in beating at this time of year, perhaps ill-luck was inadvertently added through disregarding the idiosyncrasies of Indian shooting. It is fatal to mention the word "Kargosh" (a hare) when starting out; the partridge may have called upon the left hand side, a fatal omen up to noon, but the reverse after midday; and both the grey (*Francolinus pondicerianus*), with its cry of "pateela-pateela pateela," and the painted variety (*Francolinus pictus*), with that curious harsh call, translated by Hindus into "lahsan piaz adrak" (garlic, onions and ginger), and by Musalmans into "Khuda teri Kudrat" (God is your strength), were calling all day: a cat may have crossed the road, or some one sneezed in front (a sneeze behind is lucky). These and other similar hindrances to good luck may well have influenced the bag but they did not affect a most enjoyable outing. The shoot in Bhopal must be considered both on account of the variety of the bag and of the care and hospitality of its august ruler equal to any of the great shoots arranged by the various States in India to do honour to His Royal Highness.

NOTE ON BHOPAL SHOOTING.

Tiger (*F. tigris*).

In Bhopal the country where shoots take place offers unique opportunities for good tiger shooting. There are very large cliffs in the jungles and the beaters try to drive the tigers in the direction of the cliffs where it is difficult for them to escape. In my opinion this is the easiest method of shooting, is surer, and does not involve as much trouble and labour as the ringing and netting systems used in Nepal and Mysore respectively.

Sir Geoffrey de Montmorency told me something rather interesting in connection with tigers in Bhopal. He and Major Harvey one Sunday when they could not shoot saw a tiger sit over its kill nearly nine hours.

NOTES ON THE FAUNA AND FLORA IN THE SHOOTING DISTRICTS ROUND BHOPAL.

Fauna.—The writer well remembers being told before he visited Bhopal that the jungles of this State provide the finest mixed bags in the whole of India. This is very true.

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The most important Fauna met with in these jungles are the Langur Monkey (*Semnopithecus entellus*) whose hordes under Hanuman rescued Sita from the clutches of Ravan, the demon king of Ceylon ; the little brown bandar (*Macacus rhesus*), Tiger (*Felis tigris*), Leopard (*F. pardus*), Hyæna (*H. striata*), Wild dog (*Cyon dukhunensis*), Jackal (*Canis aureus*), Black Bear (*Melursus ursinus*), Nilgai* (*Boselaphus tragocamelus*), Black Buck (*Antilope cervicapra*), the Four-horned antilope (*Tetracervus quadricornis*), Chital (*Cervus axis*), Sambhar (*C. unicolor*), Wild Boar (*Sus cristatus*).

The bison and buffalo, once common, have long disappeared in this part of the country. In Mughal days elephants and lions were numerous, the lion surviving in the neighbourhood to modern times, the last being shot near Guna on Waterloo day 1872. The usual game birds and reptilia of course exist in this area.

Round Kachnaria, tales of snakes being numerous and scorpions abounding were circulated, as is not unusual, the presence of such unpleasant neighbours being calculated to impress visitors. But in point of fact Colonel Luard, who is

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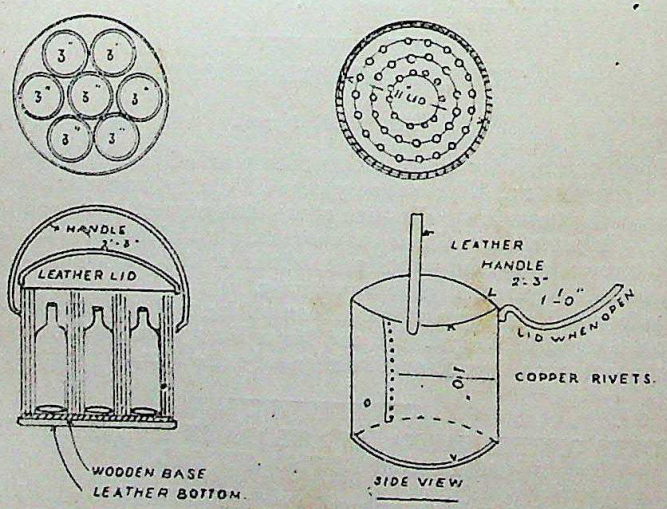
* Regarding Nilgai, Col. Luard, the Political Agent in Bhopal, told me of a rather useful way of making use of a Nilgai skin when shot. In view of the fact that a Nilgai is generally considered one of the poorest trophies afforded to the sportsman in India—this information is most valuable. Col. Luard told me "A Nilgai skin, if chrome tanned is porous and make a wonderful water cooler : it will make a jar of butter placed in it in the hot weather as hard as if it had been iced, and make the temperature of water as cold as possible." Col. Luard very kindly had a drawing made for me of a Nilgai skin water cooler. Nilgai marrow bones by the way are as is well known, exceedingly good eating. The leather is as good as sambhar leather for making shikar boots and gaiters.



NILGAI SKIN WATER-COOLER.

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a considerable expert on such matters and who has given much practical study to the natural history of the country round Bhopal, told me snakes are not particularly abundant and scorpions are always very local in their habitat.

Speaking generally as regards the natural history of these regions there is probably little to be done, in bird identification, but much in other respects such as nidification, migration, local prevalence, etc. On the other hand, entomology certainly, and probably the study of snakes and other reptiles, would repay observers. Something, but not very much, has been done here by the Society's Mammal Survey of India.

Flora.—The jungles round Bhopal consist mainly of deciduous trees containing a large number of flowering trees and shrubs. Unluckily February was too early for the "flame of the forest," the "kakra" (*Butea frondosa*) whose fiery glare lights up the country side in March. At this season only the brown green buds were to be seen. The "ganiar" also (*Cochlospernum gossypium*) was not yet bearing its brilliant yellow flowers. The "teak" (*Tectona grandis*), here but a stunted variety, stood out conspicuously with its huge leaves. These latter sometimes obstruct the sportsman's view, when shooting, and often rouse his ire by their incessant crackling. The white-stemmed and delicately leaved "dhaora" (*Anogeissus latifolia*), often used to bear machans on its strong boughs; the "mahua" (*Bassia latifolia*), whence the country liquor now taboo under prohibition in Bhopal comes, was just commencing to bear flowers; along the banks of streams the "kahua" (*Terminalia arjuna*) which produces a good tannin, was conspicuous for its winged fruit. Other trees were the Nim (*Azadirachta indica*); Indian Ebony (*Diospyros tomentosa*) with its dark black stem; clinging to cliffs in the most precipitous places stood out the "ghost tree" (*Sterculia urens*) lifting its weird pinky white arms to the sky; the aerial rooted banian tree (*Ficus indica*) (so called from a well known specimen at Gombroon under which "Banias" sat awaiting orders from the factory); the Pipal (*Ficus religiosa*) whose leaves the gods delight to inhabit thus making it sacred to Hindus; the tall spiky-stemmed Silk-cotton tree, the "Semel" (*Bombax malabaricum*) just commencing to glow with scarlet blossoms; the leafless "salai" (*Boswellia serrata*) with its peeling bark and gum-oozing trunk; the "Amaltas" or "Indian Laburnum" (*Cassia fistula*) at this season without its lovely cascades of yellow flowers; the shady Tamarind (*T. indica*); the Mango, then covered with its scented flowers; Acacias of many kinds amongst which the brilliant green of the Babul (*Acacia arabica*) outshines all; the Caronda (*Carissa carondas*) with its small sweet-smelling blossom. Among smaller trees and shrubs, the *Parkinsonia*, with its yellow showy flowers, the curious "Madar," the *Calotropis* with its artificial looking white and purple blossom and poisonous milky juice used at times to remove undesired female offspring, and the palm tree familiar wherever there is water. All these and many others less conspicuous were met with a hundred times in traversing the forests from shoot to shoot. Colonel Luard, whose knowledge on botany is considerable, was most assiduous in pointing the different trees and shrubs out to us.

BARODA.

The only sport which the limited time of H. R. H.'s visit to Baroda permitted was a cheetah hunt. This was arranged at His Highness' preserve at Sunderpura on the morning of the second day. Their Highnesses and staff, and the Resident moved out with the carts and quickly came up to a large herd of buck. One cart was sent on with a cheetah on it and was about to be loosed at a buck, when a crowd of men in white suits with note books, sketch books, cameras and hand cinemas, lept up from under every bush and charged the herd. It stampeded and frightened every buck for miles. For over two hours attempts to find more buck were made and at last a few were found. His

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Royal Highness went off after these with a cheetah and after a long and careful approach, the cart got close enough to allow the cheeta to be loosed and he killed very quickly.

SHOOTING AT BIKANER DURING H. R. H. THE PRINCE OF WALES' VISIT.

In the previous number of the Journal the writer included the bag of Imperial Sand Grouse and Small Game obtained at Bikaner.

The following notes on the habits of Imperial Sand Grouse in Bikaner, which were not ready on the previous occasion and are now published, are of interest in connection with the illustrations and the detailed statement of the bag.

The shooting season is, usually, from 1st November to 1st February and a shoot takes place early in the mornings from about 7-30 to about 10-30 during which hours the birds come to drink. Butts are placed in suitable lines and places, some 50 yards from each other, and the success of a shoot mostly depends on the manner in which the butts are placed. For instance, the placing of one butt in the wrong place might absolutely ruin the shooting of say 15 other guns, as the birds are very cunning and as a rule do not come over the butts a second time after being fired at. When a pack of grouse is approaching a butt the gun has to keep well down under cover of the butt. If the shooter is spotted by the birds they, more often than not, swerve away out of range. After the first shot is fired at a pack they go at a tremendous place jinking and swerving over and even between butts, rendering the shooting most difficult and exciting. In a good year something like 50,000 birds come to drink at one place. They travel from 20 to 30 miles in the early morning for their drink and will always go to their favourite place, passing over other tanks where they could easily get a drink. They come in thousands and very hot shooting indeed is afforded for about an hour when guns—particularly those who are not used to such shooting—get bewildered, as the birds come from every direction and, unless accustomed to it, the guns find it very hard to pick out their birds, and the shooting must be good as they carry a great quantity of shot. Three guns—all being used as quickly as the two loaders can reload and hand them to the shooter—are required to cope with these birds and to be able to make a really good bag.

Gujner is not the only place where excellent shooting can be had. H. H. the Maharaja once shot 475 Imperial Sand-Grouse to his own gun in one morning's shoot at Pilap—a pretty spot some 11 miles from Gujner.

All previous records were broken lately on a recent visit to Bikaner of His Excellency Lord Rawlinson. The total bag for the 2 mornings shoot was :—

Imperial Sand-Grouse	5,963
Other Sand-Grouse	43
Duck	2

The statement of bag here given of the Royal Shoot includes all birds picked up and therefore slightly exceeds the totals given in Vol. XXVIII, No. 3, pages 692 and 693.

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BAG OF DEMOISELLE CRANE—KODAMDESAR, BIKANER, DECEMBER 1921.

BAG OF IMPERIAL SAND GROUSE—GUJNER, BIKANER, DECEMBER 1921.

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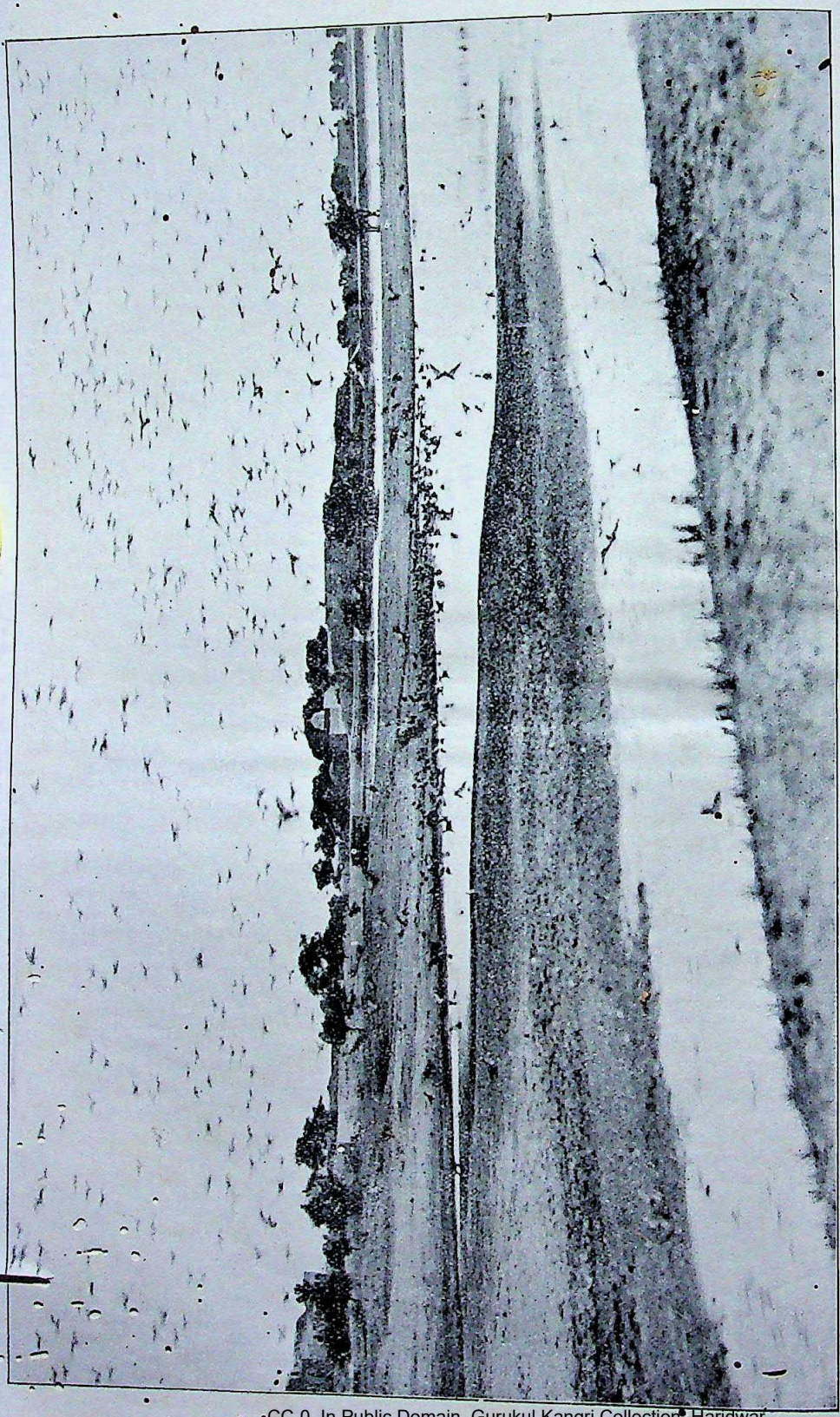

IMPERIAL SAND GROUSE DRINKING—GUJNER, BIKANER, DECEMBER 1921.

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STATEMENT OF BAG OF THE ROYAL SHOOT IN BIKANER.

December 3rd to December 7th, 1921.

Number of Guns.	Name.	Place.	Black buck. Number.	Black buck. Head.	Chinkara. Number.	Chinkara. Head.	Bustard.	Houbara.	Demoiselle Crane.	Duck.	Imperial Sand Grouse.	Sand Grouse.	Partridge.	Snipe.	TOTAL.
			3rd December (morning).												
1	HIS ROYAL HIGHNESS	KODAMDESAR ..	..	..	..	..	..	..	4	..	..	..	..	..	4
2	Lieut.-Colonel O'Kinealy	,, ..	..	..	..	..	..	..	4	..	..	..	..	..	4
3	Surgeon Commander Newport	,, ..	..	..	..	..	..	..	3	..	..	..	..	..	3
4	Mr. Petrie ..	,, ..	..	..	..	..	..	..	3	..	..	..	..	..	3
5	Mr. de Montmorency ..	,, ..	..	..	..	..	..	..	2	..	..	..	..	..	2
6	Sir Godfrey Thomas ..	,, ..	..	..	..	..	..	..	2	..	..	..	..	..	2
7	Capt. the Hon. Piers Legh	,, ..	..	..	..	..	..	..	2	..	..	..	..	..	2
8	Capt. the Hon. Bruce Ogilvy	,, ..	..	..	..	..	..	..	2	..	..	..	..	..	2
9	Lieut.-Colonel Harvey ..	,, ..	..	..	..	..	..	..	2	..	..	..	..	..	2
10	The Earl of Cromer ..	,, ..	..	..	..	..	..	..	1	2	..	..	..	..	3
11	Sir Lionel Halsey ..	,, ..	..	..	..	..	..	..	1	2	..	..	..	..	3
12	The Maharaj Kumar ..	,, ..	..	..	..	..	..	..	1	..	..	..	..	..	1
13	Captain Dudley North ..	,, ..	..	..	..	..	..	..	1	..	..	..	..	..	1
14	Captain Metcalfe ..	,, ..	..	..	..	..	..	..	1	..	..	..	..	..	1
15	Lord Louis Mountbatten.	,, ..	..	..	..	..	..	..	1	..	..	..	..	..	1
	Picked up ..	..	..	..	..	..	..	..	27	6	..	..	..	..	33
			3rd December (afternoon).												
1	HIS ROYAL HIGHNESS	GUJNER ..	..	..	..	..	..	..	..	35	..	..	..	..	35
2	Sir Lionel Halsey ..	,, ..	..	..	..	..	..	..	..	35	..	..	..	..	35
3	Lieut.-Colonel Harvey ..	,, ..	..	..	..	..	..	..	..	33	..	..	..	..	33
4	The Earl of Cromer ..	,, ..	..	..	..	..	..	..	..	28	..	..	..	..	28
5	Mr. de Montmorency ..	,, ..	..	..	..	..	..	..	..	8	..	..	..	..	8
6	His Highness	,, ..	..	..	..	..	..	..	..	3	..	..	..	..	3
7	Lord Louis Mountbatten.	,, ..	..	..	..	..	..	..	..	3	..	..	..	..	3
1	Colonel Worgan ..	CHANDASAGAR ..	..	..	..	..	..	..	..	23	..	..	..	..	23
2	Surgeon Commander Newport	,, ..	..	..	..	..	..	..	..	7	..	..	..	..	7
3	Mr. Petrie ..	,, ..	..	..	..	..	..	..	..	5	..	..	..	..	5
4	Lieut.-Colonel O'Kinealy-	,, ..	..	..	..	..	..	..	..	4	..	..	..	..	4
5	Captain Poynder ..	,, ..	..	..	..	..	..	..	..	4	..	..	..	..	4
6	Captain Metcalfe ..	,, ..	..	..	..	..	..	..	..	1	..	..	..	..	1
1	Captain the Hon. Piers Legh	SUGANSAGAR ..	..	..	..	..	..	..	..	25	..	..	..	..	25
2	Captain Dudley North ..	,, ..	..	..	..	..	..	..	..	17	..	..	..	..	17
3	The Maharaj Kumar ..	,, ..	..	..	..	..	..	..	..	7	..	..	..	..	7
4	Mr. Metcalfe ..	,, ..	..	..	..	..	..	..	..	6	..	..	..	..	6
5	Captain the Hon. Bruce Ogilvy	,, ..	..	..	..	..	..	..	..	4	..	..	..	..	4
6	Sir Godfrey Thomas ..	,, ..	..	..	..	..	..	..	..	3	..	..	..	..	3
1	Maharaj Sri Bijey Singhji	GOLRI ..	..	..	..	..	..	..	..	8	..	..	..	..	8
	Picked up ..	..	..	..	..	..	..	..	..	231	..	..	..	..	[illegible]

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Number of Guns.	Name.	Place.	Black buck. Number.	Black buck. Head.	Chinkara. Number.	Chinkara. Head.	Bustard.	Houbara.	Demoiselle Crane.	Duck.	Imperial Sand Grouse.	Sand Grouse.	Partridge.	Snipe.	Total.	Number of Guns.
			3rd December (afternoon)—contd.													
1	His Highness the Maharajah Jam Saheb of Nawanagar	DURBARI ..	..	..	..	..	..	..	3	9	..	2	..	..	14	21
2	His Highness the Nawab Sahib of Palanpur ..	,, ..	..	..	..	..	..	..	1	2	..	..	..	..	3	22
3	Sir Philip Grey-Egerton.	,, ..	..	..	..	..	..	..	1	2	..	..	..	..	3	23
4	Sir Harry Watson ..	,, ..	..	..	..	..	..	..	..	2	..	..	..	..	2	24
	Picked up ..		..	..	..	..	..	..	5	10	..	1	..	..	16	25
1	Captain Walker ..	KODAMDESAR ..	..	..	..	..	..	..	2	12	..	4	..	..	18	
2	Mr. Holland ..	,, ..	..	..	..	..	..	..	2	8	..	3	..	..	13	
3	Mr. Ashdown ..	,, ..	..	..	..	..	..	..	..	7	..	..	..	..	7	
			5th December (morning).													
1	HIS ROYAL HIGHNESS	GUJNER ..	..	..	..	..	..	..	..	..	65	..	..	..	65	
2	His Highness ..	,, ..	..	..	..	..	..	..	..	..	138	..	..	..	138	
3	Sir Lionel Halsey ..	,, ..	..	..	..	..	..	..	..	1	87	..	..	..	88	1
4	The Earl of Cromer ..	,, ..	..	..	..	..	..	..	..	..	45	..	..	..	45	2
	Picked up ..		..	..	..	..	..	..	..	1	322	..	..	..	323	3
1	The Maharaj Kumar ..	SUGANSAGAR ..	..	..	..	..	..	..	..	1	55	..	..	..	56	4 5 6
2	His Highness the Maharajah Jam Sahib of Nawanagar	,, ..	..	..	..	..	..	..	..	..	52	..	..	..	52	7 8
3	His Highness the Nawab Sahib of Palanpur ..	,, ..	..	..	..	..	..	..	..	..	51	..	..	..	51	9
4	Colonel Worgan ..	,, ..	..	..	..	..	..	..	..	..	46	..	..	..	46	10
5	Mr. de Montmorency ..	,, ..	..	..	..	..	..	..	..	..	42	..	..	..	42	11
6	Sir Philip Grey-Egerton.	,, ..	..	..	..	..	..	..	..	..	36	..	..	..	36	12
7	Captain Metcalfe ..	,, ..	..	..	..	..	..	..	..	..	33	..	..	..	33	13
8	Captain the Hon. Piers Legh	,, ..	..	..	..	..	..	..	..	..	32	..	..	..	32	14
9	Captain Dudley North..	,, ..	..	..	..	..	..	..	..	..	32	..	..	..	32	15
10	Sir Godfrey Thomas ..	,, ..	..	..	..	..	..	..	..	..	30	..	..	..	30	
11	Captain Walker ..	,, ..	..	..	..	..	..	..	..	..	28	..	..	..	28	
12	Mr. Petrie ..	,, ..	..	..	..	..	..	..	..	..	25	..	..	..	25	
13	Captain the Hon. Bruce Ogilvy	,, ..	..	..	..	..	..	..	..	..	24	..	..	..	24	
14	Sir Harry Watson ..	,, ..	..	..	..	..	..	..	..	..	24	..	..	..	24	
15	Mr. Ashdown. ..	,, ..	..	..	..	..	..	..	..	..	23	..	..	..	23	
16	Lieut.-Colonel Harvey ..	,, ..	..	..	..	..	..	..	..	..	22	..	..	..	22	
17	Commander Fry ..	,, ..	..	..	..	..	..	..	..	..	22	..	..	..	22	1
18	Capt[illegible] Beileau ..	,, ..	..	..	..	..	..	..	..	..	21	..	..	..	21	
19	Mr. Holland ..	,, ..	..	..	..	..	..	..	..	..	20	..	..	..	20	
20	Captain Poynder ..	,, ..	..	..	..	..	..	..	..	..	19	..	..	..	19	

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Number of Guns.	Name.	Place.	Black buck. Number.	Black buck. Head.	Chinkara. Number.	Chinkara. Head.	Bustard.	Houbara.	Demoiselle Crane.	Duck.	Imperial Sand Grouse.	Sand Grouse.	Partridge.	Snipe.	Total.
			5th December (morning)—contd.												
21	Surgeon Commander Newport	SUGANSAGAR ..	..	..	..	..	..	..	..	..	15	..	..	..	15
22	Mr. Metcalfe ..	,, ..	..	..	..	..	..	..	..	..	15	..	..	..	15
23	Maharaj Sri Bijey Singhji	,, ..	..	..	..	..	..	..	..	1	12	..	..	..	13
24	Lord Louis Mountbatten	,, ..	..	..	..	..	..	..	..	..	8	..	..	..	8
25	Lieut.-Colonel O'Kinealy.	,, ..	..	..	..	..	..	..	..	..	8	..	..	..	8
	Picked up ..	..	..	..	..	..	..	..	..	2	670	..	..	..	672
	Other visitors 6 ..	KHARI ..	..	..	..	..	..	..	..	..	12	6	..	..	18
	Picked up ..	..	..	..	..	..	..	..	..	..	12	6	..	..	18
1	Sir Harry Watson ..	KODAMDESAR ..	..	..	..	..	..	..	..	..	..	41	..	..	41
2	Captain Walker ..	,, ..	..	..	..	..	..	..	..	..	..	40	..	..	40
3	Commander Fry ..	,, ..	..	..	..	..	..	..	..	..	..	31	..	..	31
4	Mr. Petrie ..	,, ..	..	..	..	..	..	..	..	..	..	28	..	..	28
5	Lieut.-Colonel Harvey ..	,, ..	..	..	..	..	..	..	..	..	..	27	..	..	27
6	Colonel Worgan ..	,, ..	..	..	..	..	..	..	..	..	..	26	..	..	26
7	Surgeon Commander Newport	,, ..	..	..	..	..	..	..	..	..	..	26	..	..	26
8	Captain Dudley North ..	,, ..	..	..	..	..	..	..	..	..	..	21	..	..	21
9	Capt. the Hon. Piers Legh	,, ..	..	..	..	..	..	..	..	..	..	20	..	..	20
10	Mr. Ashdown ..	,, ..	..	..	..	..	..	..	..	..	1	17	..	..	18
11	Mr. de Montmorency ..	,, ..	..	..	..	..	..	..	..	..	..	14	..	..	14
12	Mr. Metcalfe ..	,, ..	..	..	..	..	..	..	..	..	..	12	..	..	12
13	Captain the Hon. Bruce Ogilvy	,, ..	..	..	..	..	..	..	..	..	..	6	..	..	6
14	Sir Godfrey Thomas ..	,, ..	..	..	..	..	..	..	..	..	..	5	..	..	5
15	Lieut.-Colonel O'Kinealy.	,, ..	..	..	..	..	..	..	..	..	..	3	..	..	3
	Picked up ..	..	..	..	..	..	..	..	..	..	2	250	..	..	252
			5th December (afternoon).												
1	Sir Lionel Halsey ..	GUJNER (NEAR BATTIA) ..	1	21¼″	..	..	..	..	..	..	..	..	..	..	1
		MADHOLAO ..	..	..	1	7¾″	..	..	..	..	..	..	..	..	1

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Number of Guns.	Name.	Place.	Black buck		Chinkara.		Bustard.	Houbara.	Demoiselle Crane.	Duck.	Imperial Sand Grouse.	Sand Grouse.	Partridge.	Snipe.	Total.
			Number.	Head.	Number.	Head.									
			6th December (morning).												
1	HIS ROYAL HIGHNESS	SUGANSAGAR	..	..	..	..	..	..	..	..	54	1	..	..	55
2	His Highness ..	,, ...	..	..	..	..	..	..	..	..	69	1	..	..	70
3	Sir Lionel Halsey ..	,, ...	..	..	..	..	..	..	..	..	64	..	..	..	64
4	His Highness the Nawab Sahib of Palanpur ..	,, ...	..	..	..	..	..	..	..	..	53	..	..	..	53
5	Mr. de Montmorency ..	,, ...	..	..	..	..	..	..	..	..	46	..	..	..	46
6	Lieut.-Colonel Harvey ..	,, ...	..	..	..	..	..	..	..	..	40	..	..	..	40
7	Capt. the Hon. Bruce Ogilvy	,, ...	..	..	..	..	..	..	..	..	34	..	..	..	34
8	Commander Fry ..	,, ...	..	..	..	..	..	..	..	..	26	..	..	..	26
9	Major Jackson ..	,, ...	..	..	..	..	..	..	..	..	24	..	..	..	24
10	The Earl of Cromer ..	,, ...	..	..	..	..	..	..	..	..	21	..	..	..	21
11	Mr. Metcalfe ..	,, ..	..	..	..	..	..	..	..	..	14	..	..	..	14
12	Surgeon Commander Newport	,, ..	..	..	..	..	..	..	..	..	14	..	..	..	14
13	Mr. Petrie ..	,, ...	..	..	..	..	..	..	..	..	14	..	..	..	14
14	Maharaj Sri Bijey Singhji	,, ...	..	..	..	..	..	..	..	..	11	1	..	..	12
15	Sir Godfrey Thomas ..	,, ...	..	..	..	..	..	..	..	..	11	..	..	..	11
16	Captain Dudley North ..	,, ...	..	..	..	..	..	..	..	..	10	..	..	..	10
17	Captain Poynder ..	,, ...	..	..	..	..	..	..	..	1	9	..	..	..	10
18	Kumar Sri Bhawani Singhji	,, ...	..	..	..	..	..	..	..	..	8	..	..	..	8
19	Mr. Percival Landon ..	,, ...	..	..	..	..	..	..	..	..	7	..	..	..	7
20	Captain Boileau ..	,, ...	..	..	..	..	..	..	..	..	7	..	..	..	7
21	Colonel O'Kinealy ..	,, ...	..	..	..	..	..	..	..	..	5	..	..	..	5
22	Lord Louis Mountbatten.	,, ...	..	..	..	..	..	..	..	..	5	..	..	..	5
	Picked up ..	.. ..	..	..	..	..	..	..	..	1	508	5	..	..	514
1	The Maharaj Kumar ..	GUJNER	..	..	..	..	..	..	..	..	120	1	..	..	121
2	His Highness the Maharajah Jam Sahib of Nawanagar	,, ...	..	..	..	..	..	..	..	..	90	20	..	..	110
3	Colonel Worgan ..	,, ...	..	..	..	..	..	..	..	..	50	5	..	..	55
4	Capt. the Hon. Piers Legh	,, ...	..	..	..	..	..	..	..	1	49	..	..	..	50
5	Sir Philip Grey-Egerton.	,, ...	..	..	..	..	..	..	..	..	30	..	..	..	30
	Picked up ..	.. ..	..	..	..	..	..	..	..	..	300	34	..	..	334
	HIS ROYAL HIGHNESS	*6th December (afternoon).* GUJNER BIR. ..	1	$20\frac{1}{4}''$	..	..									
		,, ..	1	$18\frac{1}{2}''$	..	..									
		ON GUJNER ROAD NEAR KOTRA ..	..	..	1	$10\frac{1}{4}''$	..	..	..	..	..	..	..	..	3
2	Lord Louis Mountbatten.	NEAR PARTRIDGE COVERT ..	..	..	1	$11\frac{1}{8}''$	..	1							
		,, ..	..	..	1	$11''$	..	..							
		,, ..	..	..	1	$9''$	..	..	..	..	..	..	..	..	5
		NEAR GUJNER-KODAMDESAR ROAD ..	..	..	1	$9\frac{3}{4}''$	..	..							

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Dr. TICEHURST'S APPEAL.

Our members may be interested to learn that Dr. Ticehurst has just written to me with reference to his appeal for spirit specimens of chicks of Indian or other birds which recently appeared in the Journal. He informs me that he has now examined the chicks of about 70 species of Indian birds and that this material, although of course insufficient for any definite results of value, has shown that the enquiry, if continued, is likely to be most interesting and to throw a good deal of light on classification problems. It appears however that very few members have responded to the appeal, the majority of the specimens being due to the efforts of two members only. I think possibly many people are deterred from helping from the idea that it is a matter for the expert alone, and also by the somewhat formidable thought of "spirit specimens". May I disabuse them of these ideas.

Anyone can help with even a very slight knowledge of Indian birds. Every observer or sportsman automatically comes across a nest or two during the year, or meets with the downy chick of some game bird. At present almost every species is still a desideratum, so there need be no fear that any chick found is too common to be wanted. So if only our members would make up their minds to save a specimen of any young chick they come across, it would help on the survey immensely and immediately. The only thing required is that the chick must be named, though some slight latitude can be allowed in this respect. At the present state of the enquiry a Bee-eater chick for instance would be of value even if the sender could not accurately determine the actual species.

There is no need to be frightened of the idea of a "spirit specimen"; all that is required is to drop the chick into a small bottle of any common spirit, whatever is handy: personally I find spirits of wine the best but others may have something else more handy. If more than one chick is obtained, to prevent subsequent confusion, a little card can be tied to one leg: on the card the name of the bird should be written in pencil; ink of course would wash out.

If any member like to send his specimens to me I can forward them to Dr Ticehurst in England. For posting, simply wrap each chick in a small bit of cloth after it has soaked for about a week in the spirit, and damp the cloth with spirit. Then pack in the ordinary way in a tin or wooden box. If several specimens are obtained it is often easier to send them along in the original spirit bottle, though wrapped separately in cloth to avoid jolting; all the spirit, except as much as the cloth absorbs, can be poured out before packing: this saves postage and avoids leakage.

May I remind our Oological members that the chick exhibits down before hatching, that is to say a hard set egg, which cannot be saved for the egg collection, will be of value to Dr. Ticehurst. Simply make a hole in the shell to admit spirit and add the egg to the spirit bottle. The most convenient way of labelling, if several eggs are likely to be confused, is to wrap a piece of cloth round the egg inserting in it a slip with the name pencilled on it.

To end up:—The eggs of most Indian birds are well known by now, but the chicks of nearly all are unknown. On the present state of our knowledge more is to be learnt from one chick than a dozen clutches of eggs.

Dharmsala, Punjab,
24*th June* 1922.

HUGH WHISTLER, F.Z.S.,
Indian Police.

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ZOOLOGICAL INVESTIGATIONS IN THE PERSIAN GULF AND IRAQ.

BY

CAPTAIN R. E. CHEESMAN, F.R.G.S., C.M.Z.S., M.B.O.U.

After what has been, I fear, a long silence, you will be interested to hear a short account of the itinerary and work of the Society's Collector, Mr. La Personne, kindly placed at the disposal of Sir Percy Cox and employed by him on Zoological investigations in the Persian Gulf. His Excellency's first intention was to obtain a man to preserve specimens of Palæarctic birds that during the spring migration might be expected to be killed at the lighthouse on Quoin Island, a small rock which geographically seemed well placed to catch a migration stream passing through Arabia and crossing the Persian Gulf to Persia. It was finally decided however that the Tanb Island Lighthouse would be more suitable as, being on an island some 6 miles in circumference, the land could be worked for resting birds in addition to those attracted to the light. The choice was fortunate for that reason. Not a single bird was obtained at the lighthouse itself and it may confidently be stated that, probably owing to the clear atmosphere, lighthouses in these regions may be neglected as far as migration is concerned. Every assistance to the project was given by the Director of the Royal Indian Marine, Bombay, and Captain Poyntz, D.S.C., Commander of the R.I.M.S. "Nearchus" and his officers. La Personne arrived at Basrah in February 1921 to join the "Nearchus" where by chance I was able to meet him and travel with him on the vessel's journey of inspection of the Gulf Lighthouses and finally leave him with the lighthouse staff on Tanb Island to be called for on the ship's next visit a month later. While waiting at Basrah for the departure of the "Nearchus" we stayed at Zobeir, the desert town about 12 miles away. It was possible to introduce La Personne to several of the Palæarctic groups of migrants in the field with which of course he was then unacquainted, such as Chats, Warblers, Shrikes and Wagtails. The "Nearchus" sailed from Basrah on March 8th, 1921, and we reached Tanb Island on March 14th. The birds obtained were mostly migrants which breed on the Persian plateau and northwards, and winter in Africa, such as Buntings, Cuckoo, (*C. canorus*) Redstarts and Wheatears and three breeding birds, *Phœton*, *Lanius* and *Charadrius*.

Two species of hedgehog which have proved new to science and a quantity of reptiles and crustacea were also brought back. On La Personne's return from Tanb Island Sir Percy Cox decided to take the opportunity of attempting to clear up the status of the breeding Terns, Pelicans, Flamingoes and Crab Plovers which are known to frequent the islands at the head of the Gulf in the neighbourhood of the Khor Abdullah and Khor Musa. A considerable amount of material has been from time to time brought from this locality, but in some instances deductions had been based on baskets of unidentified eggs brought by Arab fishermen.

La Personne's instructions were to bring back nothing but clutches of eggs accompanied by the skin of the parent bird shot on the nest.

His headquarters were established at Fao on May 10th, 1921, with Mr. Hatton in charge of the Telegraph Department, and the various islands were visited by trips made in an Arab dhow. The results of these journeys were eminently satisfactory and authentic breeding records were secured of the Slender-billed Gull (*Larus gelastes*), Lesser Crested Sea Tern (*Sterna media*), Caspian Tern (*S. caspia*), White cheeked Tern (*S. albigena benghalensis*), Lesser Sooty Tern (*Sterna anæthetus*), Gull Billed Tern (*Sterna anglica*), Crab Plover (*Dromas ardeola*) and Reef Heron (*Demiegretta asha*) among others.

According to vague local information obtained in 1921 the Pelican and Flamingo had finished breeding, and not without some difficulty La Personne

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arrived at the conclusion that the month of March was a generally agreed date to find eggs. This date proved in the following year to be correct. At the time, a visit to the islands in 1922 was not contemplated and the failure to obtain any data regarding these two birds was much regretted.

The voyages to the islands had been made in very hot damp weather but beyond a touch of the sun which laid him up from June 16th to the 26th, and one or two storms which are unpleasant in these small sailing boats, La Personne left Fao on July 3rd for Qurnah none the worse for his experiences. The objective now was the vast marshes which ornithologically are little known at the breeding season. We had that year received a large basket of mixed eggs from one of the Shaikhs, and La Personne's instructions were as before to visit the breeding colonies and bring back only clutches of which he had shot the parent bird. Headquarters in this area were made at Qurnah on July 7th and then voyages of 2 or 3 days' duration were made into the heart of the marshes with the marsh Arabs in their canoes—paddling or poling mile after mile along lanes in a forest of reeds 18 feet high. The official recorded temperature at this time ran up to 128° in the shade and made the work no sinecure especially as the atmosphere is heavily laden with moisture and mosquitoes. The season was drawing to a close. In all the colonies located most of the eggs had hatched and the few that remained were in an advanced stage of incubation.

Clutches with parent birds were however secured of The Night Heron (*Nycticorax nycticorax nycticorax*), Squacco Heron (*Ardeola ralloides*), White Ibis (*Threskiornis æthiopicus*), African Darter (*Anhinga rufus*), Pigmy Cormorant (*Phalacrocorax pygmaeus*), all five being the first authentic breeding records for Iraq. La Personne had the satisfaction of remaining fit during these expeditions while the marsh Arabs were in some cases laid out by heat stroke! On receiving instructions to proceed to Baghdad he left Qurnah on August 7th. For the rest of the year he remained in Baghdad. After writing up notes and arranging his specimens he was employed in collecting in the neighbourhood, making series of the birds that have hitherto been scarcely represented in collections.

From February 1st to the 11th, 1922, he was sent to Daur between Samarrah and Tekrit on the Tigris to work the conglomerate cliffs 30 feet to 60 feet high where in February and March Captain Aldworth had previously found nests and eggs of the white-tailed Sea Eagle, Bonelli's Eagle and the Eagle Owl. Several other cliff-breeding birds were considered likely to be found there. La Personne however failed to locate any and returned without any specimens.

Sir Percy Cox, now determined to make one more attempt to clear up the status of the Pelican at Fao, fix the actual date and locality of the breeding operations and determine the species of the breeding birds. La Personne arrived at Fao on February 18th and found quarters as before with Mr. Hatton of the Telegraph Department. He then searched Warba and Bubiyan islands in the Khor Abdullah and Dara and Boonah in the Khor Musa and all likely places in their vicinity. He saw pelicans moving about but found no sign of a breeding colony and formed the opinion that he was too early and wired to Baghdad accordingly. We replied that he should wait and try again in a month's time. About the middle of April on the next visit to Bubiyan he discovered the breeding ground of Pelican with young in down and near by a colony of Flamingo with eggs. The pelicans kept well out of range and after an unsuccessful attempt to shoot the parents he took some of the young pelicans and eggs of the Flamingo and sailed for Fao. As ill-luck would have it a heavy storm broke over them on the way and the jolly-boat in which the young pelicans were travelling was swamped during the night and sank with the specimens. As however spirit specimens of young in down and adults of the Crab Plover were required for investigation into the generic affinities of this peculiar wader, Sir Percy Cox, decided to take this opportunity of procuring them and La Personne was instructed to avail

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the period of hatching and visit their colonies and bring specimens. These were duly secured by June 10th, 1922, and he left on June 21st for Basrah with his specimens which included eggs of the large crested Sea Tern (*Sterna bergii velox*). Spoon-bill (*Platalea leucorodia*) and Common Heron (*Ardea cinerea cinerea*) and the white phase of the Reef Heron (*Demiegretta asha*) in addition to other species which were also obtained last year and a quantity of skins of migrants. Also a series of young in down of Gull-billed Tern (*S. anglica*), Lesser-crested Sea Tern (*S. medii*), Slender-billed Gull (*Larus gelastes*) and Crab Plover (*Dromas ardeola*).

La Personne's activities were next directed to Basrah to obtain, if not too late in the season, skins and eggs of the Babylon Reed Warbler, (*Calamoherpe griseldis=Acrocephalus babylonicus*) of Ticehurst. With the kind assistance of Mr. A. G. Tomlinson a few eggs and skins of this rare Warbler were obtained in the reed beds of the Shatt-al-Arab. A short excursion was also made to Zobeir and Jabal Sanam to endeavour to procure more specimens of the Desert Lark (*Ammomanes deserti*), Black-crowned Finch Lark (*Pyrrhulauda frontalis*) and specimens and nests and eggs of the Bifasciated Lark (*Alaemon alaudipes pallida*); series of skins from this area being desiderata. La Personne found the Desert Lark in some numbers at Jabal Sanam but unfortunately mistook their identity and only brought back one specimen Adults and flying young of the Bifasciated Lark were brought home but the Finch Larks were not seen. On July 20th, 1922, La Personne arrived in Baghdad and though the breeding season was nearly over it was considered there might be just time to clear up a few more points in the marshes around Musaiyib on the Euphrates whence well intentioned Shaikhs had sent in baskets of nameless eggs of marsh birds such as Terns, Grebes and many waders.

Of first importance was to determine the status of the White-winged Black Tern (*Hydrochelidon leucoptera*). This bird had been constantly seen coming northwards in the spring but strange to say no reliable record existed as to its breeding in Iraq. The Gull-billed Tern, Slender-billed Gull and three kinds of grebe were all undoubtedly represented in the egg basket but required clutches and parents to confirm their position as breeders. There was also the possibility that young in down of the White-tailed Plover (*Chettusia leucura*) and other waders would be encountered.

La Personne left for the Euphrates on July 25th and returned August 6th with 2 clutches of eggs of the White-winged Black Tern with parents, which were probably the last of the year; also an adult Whiskered Tern. The other birds mentioned were not forthcoming. For the last few weeks he has been occupied in writing up his notes and arranging specimens of this year's collections.

The birds are being sent in batches to Dr. C. B. Ticehurst who in spite of fully occupied days has kindly consented to look them through so we may have on doubt as to their correct identification.

"Affairs of State" have made insistent calls on time during the last two years and it has only been possible so far to collect, label and list these and other specimens and keep the notes up to date and in an intelligible form.

It is our hope eventually to marshal the facts and summarise the results in the form of two or more papers to be offered for publication in the journal of the B. N. H. S. if so desired.

[The Editors will be very pleased to publish further papers from Capt. Cheesman giving the results of his and Mr. La Personne's investigations. They take this opportunity of expressing the pleasure the Committee feel over the good work done by their young collector.]

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REPORT OF THE COMMITTEE OF THE BOMBAY NATURAL HISTORY SOCIETY, 1921-22.

The Committee of the Bombay Natural History Society have the honour to submit herewith their report on the operations and the progress of the Society covering a period from 1st August 1920 to 31st October 1922.

Patron and Vice-Patrons.

His Royal Highness the Prince of Wales, K.G., is the Patron of the Society and it is hoped that several of the Ruling Princes in India who are members of the Society will become Vice-Patrons.

Administration.

The administration of the institution is directed by a Committee consisting of a President, three Vice-Presidents, an Honorary Secretary, Honorary Treasurer and 20 members. The Museum and Library are in the charge of a Curator. The Editorship of the Journal is in the hands of the Honorary Secretary who is assisted by joint editors.

The following is the personnel of the management for the current year :—

President.

His Excellency Sir George Lloyd, G.C.I.E., D.S.O.

Vice-Presidents.

Mr. J. D. Inverarity, B.A., LL.B.
The Hon'ble Sir Norman Macleod, Kt., Chief Justice of Bombay.
H. H. The Maharao of Cutch, G.C.S.I., G.C.I.E.

Honorary Secretary.

Mr. R. A. Spence, M.L.A., F.Z.S.

Honorary Treasurer.

Mr. H. F. Lodge, M.C.

Honorary Editors.

Mr. R. A. Spence, F.Z.S., Mr. B. C. Ellison, C.M.Z.S., and Mr. S. H. Prater, C.M.Z.S.

Curator—Mr. B. C. Ellison; Assistant Curator—Mr. S. H. Prater; Head Clerk—Mr. A. F. Fernandes.

Managing Committee.

Mr. T. Bainbrigge Fletcher, F.E.S.
Mr. T. R. Bell, C.I.E., I.F.S. (Retd.)
Major R. Benson, D.S.O.
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Mr. A. E. Hefford.
Mr. J. E. B. Hotson, I.C.S.
Prof. V. N. Hate, M.A.
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Mr. H. Macnaghten, M.A., M.L.C.

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Mr. J. G. Ridland.
Mr. P. M. D. Sanderson.
Major C. H. Stockley, D.S.O.
Dr. D. A. Turkhud.
Mr. H. Whistler, F.Z.S., M.B.O.U.

and the President, Vice-Presidents, Treasurer and Honorary Secretary *ex-officio*.

Membership and Subscription.

At the annual General Meeting held in March 1921 it was decided that owing to the heavy increase in printing charges and the increased cost of administration the entrance fee should be raised from Rs. 10 to Rs. 20, the annual subscription from Rs. 15 to 25 and the Life Membership from Rs. 200 to Rs. 350. Opportunity was given to old members to compound at the old rate up to September 1921 and the result was a large increase in the number of Life Members, the number now on the rolls being 160. The increase in annual subscription resulted in a small diminution in membership but the total number now on the rolls is 1,491.

Prince of Wales' Museum.

The work of arranging the Society's show collections in the Natural History section of the Prince of Wales' Museum has made steady progress and the assistant curator, Mr. S. H. Prater, has gone on deputation to England for training in taxidermy and also to study at first hand the working of the principal Natural History Museums in the British Isles.

Towards the cost of working the Natural History section of the Prince of Wales' Museum, the Bombay Government has made an initial grant of Rs. 40,000 but it is estimated that the minimum cost of carrying out the scheme prepared by the curators will be over a lakh of Rupees and unless the scheme is to be abandoned a great effort must be made to obtain strong financial support from those who wish to see Bombay provided with a Natural History Museum worthy of the city.

Society's Apollo Street Collection.

During the period under review the Society received considerable additions to its mammal collections through the Mammal Survey, the work of which it was enabled to continue as a result of the Government of India granting in 1921 Rs. 22,500 per annum for two years for the work of the survey. The specimens sent in are being worked out by the authorities at the British Museum and it is hoped in due course to publish the scientific results in the Society's journal. Specimens have been received throughout the year from members in all parts of India and Burma and have been identified either by the scientific staff of the Society or by the authorities at the British and Indian Museums.

A keen interest in the work of the Society is maintained by its members in all parts of India and Burma and despite the increase in subscription the active membership in the period under review compares favourably with the past.

Publications.

The Society is at present publishing amongst others the following series of articles in its Journal :—

1. Game Birds of India, Burma and Ceylon, by E. C. Stuart Baker.
2. Birds of the Indian Empire, by E. C. Stuart Baker.
3. Scientific Results from the Mammal Survey.
4. The Game Animals of Kashmir and the Adjacent Hill Districts, by Col. A. E. Ward.

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5. Indian Dragonflies, by Major F. C. Fraser, I.M.S.
6. Identification of Indian Butterflies, by Col. Evans, R. E. (A Guide to beginners in Butterfly collecting).
7. Dragonfly collecting in India, by Major F. C. Fraser, I.M.S. (A Guide to beginners in Dragonfly collecting).
8. Indian Parasitic Flies, by H. Russell.

and has completed the series of papers on the Fauna of Mesopotamia and N. W. Persia.

The Society has published two volumes of the Game Birds of India, Burma and Ceylon.

H. R. H. The Prince of Wales' visit to India.

The Society's Curator, Mr. B. C. Ellison, was deputed to attend several of the shooting camps arranged in honour of His Royal Highness the Prince of Wales, and under his direction the trophies obtained by H. R. H. and staff were preserved and sent to England. Mr. Ellison also supervised the transit to Bombay of the live animals presented to His Royal Highness by the Government of Nepal.

(Sd.) R. A. SPENCE,
Honorary Secretary.

APPEAL FROM THE PROVINCIAL MUSEUM, LUCKNOW.

With a view to forming a collection of photographs illustrating Wild Life in its natural surroundings for exhibition in the Natural History Department of the Provincial Museum, Lucknow, and preparing lantern slides for circulation in schools and colleges, the Curator of the Provincial Museum, Lucknow, will be extremely obliged if any who are interested in the subject and have got any such photographs, for example pictures taken from a machan, would be generous enough to lend him photographs or negatives for reproduction.

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REVIEW.

Indian Game Birds.

The Editors offer no apology for borrowing from the "Times Literary Supplement" the subjoined review on Mr. Stuart Baker's Game-Birds of India, Burma and Ceylon. There have been several very good reviews of these books in the home journals and all have been favourable, but the one we reproduce is, we think, the best and an excellent example of what a review should be.

May we take this opportunity of asking members, who have been so fortunate as already to possess copies, to show those copies to their friends and point out the desirability of their too possessing them! Copies are obtainable from Messrs. Thacker Spink & Co., Calcutta; Thacker & Co. and Taraporewalla & Co., Bombay; Higginbotham & Co., Madras, and from the Honorary Secretary of the Society. The price in India is:—Vol. I, Rs. 63. Vol. II, Rs. 55. (Postage and packing Rs. 2 extra on each volume).

The Game-Birds of India, Burma, and Ceylon. By E.C. Stuart Baker. Volumes I. and II. (The Bombay Natural History Society, London: Bale, Sons and Danielsson. Vol. I., £4 4s.; Vol. II., £3 13s. 6d.)

The Bombay Natural History Society has earned and is maintaining a high reputation. Its museum work is excellent; and it was unfortunate that circumstances made it impossible for the Prince of Wales to visit the admirable exhibition which it had especially arranged for his inspection. The survey of the mammals of India, which the Society has in hand, is an undertaking of the first importance. The Society's Journal is among the best of the publications of its class; and one of the outstanding features of the Journal for some time past has been the series of articles by Mr. Stuart Baker which, amended and brought up to date, form the material of these two volumes, being the first half of what is to be a five-volume work.

India has always been fortunate in its writers on natural history. Among the multitude of keen sportsmen who have gone out in the Government Services, whether Civil or Military, there have been a large proportion of good amateur naturalists; and when the first-class men arose, like Jerdon and Hume, they had an immense amount of accumulated knowledge ready to their hand. Both Jerdon's work and the volumes of Hume and Marshall remain to-day astonishingly good. No one, not Mr. Stuart Baker or any other, can ever work in the same field without drawing largely on these two great reservoirs; but the mere passage of time, with the progress of science and the changes in nomenclature and systematic method, in the course of nearly half a century makes any book out of date. There is, therefore, abundant room for this work on the game-birds, as there is also room for other monographs in special fields, which will doubtless follow.

The first of the present volumes is only in a very limited sense new, being, in effect, a new edition, improved, added to and brought up to date, of the same author's "Indian Ducks and their Allies," which appeared fourteen years ago. The changes in matter consist chiefly in the incorporation of new records and the adoption—irritating but necessary—of the accepted modern nomenclature. One new species, or sub-species, of duck is, however, admitted; for Mr. Baker accepts now as a legitimate sub-species of the common Spotbill the birds of the Burmese type (*Haringtoni*) which, in his volume of 1908, he had declared to have "nothing to distinguish them from" the young of the established species. It is, or to the lay mind will seem, a small matter. No one is likely to shoot or see this particular sub-species alive in its wild state without going to Burma, the Shan States, or Cochin, the area to which it is practically confined. And only a naturalist, if he did shoot it, would recognise it as in any way differing from the common form which is found all over India, to the West, or from the Eastern form (another sub-species) which spreads over Trans-Baikalia, Eastern

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Siberia and Mongolia to Japan and Northern China. A small matter, then; but anyone who can tell just how and why these three forms arose, so nearly alike, will have in his hands the whole secret of the origin and distribution of species.

Of illustrations, this volume, as compared with the earlier publication, contains plates of the heads of two additional kinds of swan, and certain less formal photographs of the breeding-ground of the bar-headed goose in Tibet. And here, again, is a problem. Why does the bar-headed goose, which comes down at other seasons to the more comfortable latitudes of a large part of India, choose to nest and rear its young at a height of nearly 15,000 feet above the sea, and probably much higher? The natural suggestion is that it retires into the remote solitudes for the safety of isolation. Isolation from what? For when the habits of geese were formed they can hardly have had to guard against the enmity of man. The commonly accepted assumption is, moreover, that the breeding-ground of a species is its original habitat. Did the bar-headed geese, then, originate on the Himalayan heights in some far-distant past, when climatic conditions were other than they are to-day; and was it the increasing cold which, making their homeland foodless in winter, drove them down to the lower levels in search of sustenance, only to return each spring to their native haunts when the iron grip of winter was removed? This, or something like it, is probably the cause which lies at the root of all migration. But it helps us but a little way towards an understanding of the marvel of migration as a whole.

It is in the second volume, however, that English readers will find the greater fascination; for here—besides the snipes and woodcock—are the birds more characteristic of the gorgeous East, all delightfully pictured by Mr. Gronvold: the bustards, of which, including the houbara and the floricans, there are six species, and eight kinds of the lovely dove-like sand grouse. The Imperial Sand Grouse was one of the birds with which the Prince of Wales had good sport on his recent Indian tour. It is a tricky and difficult bird to shoot, coming in in flocks (it is usually shot from butts as it comes to water in the early morning), travelling at a disconcertingly high speed, with a knack of ducking—dropping, almost perpendicularly, like a stone—as soon as it catches sight of the gunner. As to the abundance of the birds at the right places, Mr. Stuart Baker quotes Hume's statement that in the course of a fifteen-mile drive he saw over one hundred packs of grouse, the packs varying in size from four or five birds to nearly a thousand. A more recent and exact record, however, is now furnished by the records of the Prince and his party at Gujner Lake, as compiled by the Maharaja of Bikaner. On the preceding morning (December 4, 1921) the Maharaja's markers had reported that about 17,000 birds had come in to drink. On the two following days the party of 40 guns (of whom, however, a dozen at outlying butts got but thirty birds among them) killed 1,946 birds, the largest individual bags being made by the Maharaja with 207 birds and H.R.H. with 119, the latter being a good record for any man shooting at so evasive a bird for the first time.

Apart from their sporting virtues, all the sand grouse are beautiful creatures. The Painted Sand Grouse, the Large Pintailed Sand Grouse, and the Tibetan Sand Grouse in particular, are even more beautiful than the Imperial race itself; and in his paintings of them Mr. Gronvold has evidently delighted in his subjects. As often in human efforts to describe the voices of birds, there is a curious discrepancy in the rendering by different observers of the Sand Grouse's note. The Imperial's note is, we are told, described by some writers as "a clucking sound difficult to write down in words," while others call it a "soft double chuckle." The Special Correspondent of *The Times* with the Prince of Wales, however, speaks of the air, as the birds came in, being full of "the sweet purring whistle" of their calls.

In view of the ineffectual efforts that have been made to re-establish the Great Bustard as a resident of the British Isles, we cannot help being a little envious

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of any country which can claim the noble bird as its own. India, however, is not much better off than we are in this matter; for only six specimens are known to have been obtained in all India, and these have been young birds. This shows, as Mr. Stuart Baker notes, what other evidence has indicated, that young birds, whether from inexperience or the heady adventurousness of youth, have a tendency to range farther on migration than their more prudent elders. But other members of the Bustard family are numerous. They have need to be; for some are easy to shoot, and the wiles by which they are circumvented by native sportsmen are many. One method is to approach them on foot behind cover of a camel, walking the camel round the birds in diminishing circles until within range. Another trick is to go after them at night with a lantern and a cowbell, the birds being accustomed to the sound of the cowbell and knowing it to mean no harm. A more laborious plan is to stud the ground thick with nooses and then walk the birds carefully into the area where the snares are set. Bustards are a favourite quarry for hawking, and have been so hunted from time immemorial. But meanest of all the devices is that of the Bhils, who light a circular fire round the bird's nest, which the hen bird promptly tries to extinguish by beating it with her wings, so singeing them that she cannot fly and is then easily run down on foot. In Jerdon's day the Great Indian Bustard was so plentiful that one man claimed to have shot over one thousand with his rifle. More recently a "so-called sportsman," as Mr. Stuart Baker describes him, in Assam shot sixty-four Bengal Floricans in a day, in the breeding season, by walking backwards and forwards across the narrow area amid waters where the birds were nesting. "It would be excellent," says Mr. Stuart Baker, "if the shooting of females could be altogether stopped for some years to come, as there is no doubt that the Florican .. .. .. has been seriously decreasing in late years."

The nineteen coloured plates in the Second Volume, as well as the majority of those in the first, are all by Mr. Gronvold, the quality of whose work is always admirable. If there is any falling away from his high standard here, it is in the picture of the Cotton Teal, where the contempt of sportsmen for that pretty but unpalatable fowl has perhaps reacted to damp the enthusiasm of the artist. The other drawings are by J. G. Keulemans and G. E. Lodge. The excellence of the former's work is well known; and it is a high compliment to the few plates by Mr. Lodge to say that they are not unworthy to stand beside the drawings of the other two masters. As for Mr. Stuart Baker's own work, it would be difficult to say where to turn for a better model of what such a book should be. The author is himself a sportsman and nature-lover as well as a naturalist. He is excellent both in his literary style and in the judgment shown in the selection of material, whether from his own experience, from earlier authorities, or from other sources.

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SOME COMMENTS ON AND CORRECTIONS OF PREVIOUS ARTICLES IN THE JOURNAL.

No. I.

I should like to make some remarks and point out some errors, mostly clerical, which have appeared in the Society's Journals and publications of late.

Starting with Mr. Stuart Baker's most interesting series on the "Game Birds of India" now being published in book form I should like to make the following comments.

If I remember correctly, there was in a former volume of the Journal a most interesting photograph of the nests of the Flamingo (*Phœnicopterus antiquorum*); it seems a pity that this was not made use of to illustrate the article on this bird in Vol. I of this work. With regard to the plates, besides agreeing with the reviewer in the Ibis of April 1922, p. 352, as to the bad reproduction of some of these, especially that of the Ruddy Skeldrake, I should like to remark on the beautiful manner in which Messrs. Vitty and Seaborne have reproduced those in Vol. II and it is to be hoped that Mr. Stuart Baker and the Society will see their way to have those of the remaining volumes printed by this firm. Grönvold's plate of the Bar-headed Goose (*A. indicus*) is a great success and a great improvement on Keuleman's in the first edition. All Keuleman's plates are very stiff and inartistic, and when one compares them with the beautiful illustrations by Thorburn and Lodge in Beebe's "Monograph of the Pheasants" and with most of Grönvold's in the Game Bird Series, one realizes how inartistic those plates really are. I should like to remark on his (Keuleman's) fondness of depicting his ducks standing on rocks in water; out of the *eight* plates painted by him for this series, *six* are standing on rocks; one on a stump of a tree in water and one on dry land. The plate of the Bronze Capped Teal (*E. falcata*) is very bad. I have had considerable experience of these birds both in a dead and a live state, besides a good number of skins passing through my hands, I have twice had live birds living in my aviary, one of the latter only died to-day.

This duck is much deeper built in front than depicted by the artist and the crest *never* bristles like a porcupine's quills set for action, but is pendant, even during excitement. The point of the long crest hangs down to the base of the hind-neck when the bird raises its head to its full extent and when in a position of repose it lies along the upper back. The elongated sickle shaped tertials do not hang over the side of the body as shown in the plate but come right over each side of the tail completely hiding it when viewed from the side. The patch on each side of the lower tail-coverts is *deep buff* not *pure white* as given by Keuleman and the black border in front of this is rather deeper in tint and more complete; the white patch in front of this border is more this shape and it is also bordered by black in front. The colour of the feet in specimens or live birds I have examined has been more of a grey hue than depicted.

The plate of the Red-breasted Merganser (*Merganser serrator*) has been by mistake placed opposite the description of the Eastern Goosander (*M. m. orientalis*) instead of opposite p. 328. The plates in Vol. II are excellent and that of the Painted Snipe (*R. capensis*) is a great improvement on the former one of the male of that bird.

Now turning to the plates of the yet unpublished portion in book form, it seems to me to be rather a pity, when Grönvold did his plate of the Nicobar Megapode (*M. nicobariensis*), he didn't depict it in the vicinity of one of its curious mounds as was done by the artist in Hume and Marshall's illustration of this bird.

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The plate of the Monal (*Lophophorus impejanus*), which is by the way miscalled *L. refulgens* on the plate, is rather unhappy. The birds are not very well drawn and the one representing the cock fails to show the line of shining metallic green, which extends from the lower side neck, backward from the mantle and breast as mentioned by Beebe. This is a most noticeable feature in full plumaged birds. It is to be hoped that a new plate of this species will be given when Vol. III of this series is published in book form.

It is rather difficult to follow the exact area included by Mr. Stuart Baker in this series. He evidently includes Tibet which can hardly be called India, and what about the inclusion of such species as the Chinese Blood Pheasant (*Ithagenes sinensis*) ? He gives no distribution of this species, but Beebe in his monograph writing of this bird says :—"The Northern Blood Partridge inhabits the subalpine slopes of the mountains of central China, the eastern Nanshan mountains in Kansu, and eastwards along the highlands of the Hoang-ho River, through central and southern Shensi in the Tsingling Range, and on into Eastern Honan. Southward we find it in north central Szechuan. Future thorough exploration will reveal much more of the range of this partridge, but at present we may roughly indicate its distribution by a triangle, with the points respectively at 102° E. 38° N. in the north ; 111° E. 34° N. in the east, and 103° E. 31° N. in the south."

The Chinese Eared Pheasant's (*C. mantchuricum*) distribution is given by Mr. Stuart Baker as "The Mountains of Manchuria and North-Eastern China." This can hardly be called India.

I also note that Mr. Baker includes Cabot's Tragopan (*Tragopan caboti*) in his key but do not understand why he does so, as he himself says :—"At present five species are known, all of which, *with the exception* of (the italics are mine) the Eastern Chinese bird, *Tragopan caboti*, come within the areas included in these articles". He also, for some unknown reason, gives all the synonyms and the vernacular name of this species but does not continue with the description.

By a clerical error the Ceylon Spur-Fowl (*Galloperdix bicalcarata*) is called the Ceylon Jungle-Fowl.

I do not know whether Mr. Stuart Baker intends to follow Mr. Beebe in his classification of the Kalij Pheasants, when publishing Vol. III of this series, but I may mention that the latter author relegates *Gennaeus h. williamsi*, *G.l. oatesi*, *G.l. sharpei*, *G. n. ripponi*, and *G. n. rufipes* to wild hybrids. He also includes Mrs. Hume's Pheasant (*P. h. humiæ*) and the Burmese Barred-back Pheasant (*P. h. burmanicus*) in the genus *Syrmaticus* instead of *Phasianus*, on account of those birds wanting the disintegrated rump feathers of the true *Phasianus* and on account of their long central tail feathers.

Now coming to the Partridges Mr. Stuart Baker gives us in his key of the Francolins, *F. p. pondicerianus*, *F. p. interpositus*, and *F. p. mecranensis*, but up to date through some oversight *none* of the Grey Partridges have been described. I brought this to the notice of the Editors of the Journal sometime ago as soon as the articles on *Arboricola* were started.

In the last number of the Journal (No. 3 of Vol. XXVIII) Mr. Baker gives the trivial name of *Perdix h. hodgsoniæ* as the Tibetan Partridge but on the plate it is called Mrs. Hodgson's Partridge.

Now coming to Mr. Stuart Baker's "List of the Birds of India," there are a good number of clerical errors which I would like to draw to the attention of the Editors so that when the list is published in book form they may be corrected. I will take number by number.

In Vol. XXVII, No. 2, the word Jungle has been omitted from the trivial name of No. 8 and in No. 170 the *ii* has been omitted from the name *earlii*.

In No. 3 of the same volume, Mr. Baker writes that *Tesia* and *Oligura* are probably Wrens, but does not seem to have put them into the *Troglodytidæ*

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and I have failed to find them mentioned anywhere, but perhaps I may have overlooked them.

On page 462 he says *Zosteropidæ* will be found near the *Dicæidæ* but places it next the *Alaudidæ* and before the *Nectariniidæ* and makes no mention of the family *Dicæidæ*.

On page 465, footnote, he says "The genus *Irena* should probably be placed in the *Turdidæ* near *Cochoa*, but he places it some distance after that genus and with two *subfamilies* in between.

No trivial name is given for No 539 *Hippolais languida*.

In No. 4 of the same volume, the serial numbers of *both Pericrocutus p. perejurius* and *P. p. vividus* are given as 664 instead of 664 and 665. *This will alter all the serial numbers subsequent to these.*

The trivial names of both Nos. 724 and 726 are given as Hume's Myna and the trivial names of both Nos. 816 and 818 are given as the Pied Chat; also the trivial names of Nos. 960 and 961 are given as Chestnut-headed instead of Chestnut-bellied Munias. The trivial names of both Nos. 1122 and 1123 are given as Tawny Pipit and no trivial name is given to No. 1145 *Alavda gulgula cælivox*.

In Vol. XXVIII, No. 1, the family *Dicæidæ* should surely have been mentioned, but all the Sunbirds and Flowerpeckers are put under the family *Nectarinidæ*.

The trivial name of No. 1236 is given as Ruby Throat instead of Ruby Cheek. In Nos. 1290 to 1293 the trivial names are spelt Pygny instead of Pigmy. In the trivial name of No. 1297 there is a *comma* instead of a hyphen.

In No. 2 of this volume the F.B.I. number in brackets of 1482 *Cacomantis m. querulus* is given as 1118 instead of 1113.

In the trivial name of No.1632 the name Eagle has been omitted after Buzzard.

The F.B.I. numbers in brackets of Nos. 1646 and 1647 should of course be 1234 and 1235 and not 1334 and 1335.

In No. 1654 the *t* has been omitted from the word Desert.

I think before publishing this list in book form it would be as well to ask Mr. Stuart Baker to revise it.

In Major Fraser's paper on Indian Dragonflies on page 620, line 19, he gives the name "Mangphu"; the usual way of spelling this is "Mangpu."

In Mr. Ellison's article on the Nepal shoot on page 691, line 16, from the bottom and on page 692, line 1 at the top, he gives the word "Invertebrates" this of course is a slip and the word should be Reptiles.

On page 790 Dr. Ticehurst wants the name of bird collectors. If he will communicate with me I shall be pleased to help him in whatever way I can. I may also mention that I will always be happy to try and obtain for the Society any of their *desiderata* from this District or from anywhere else where I may happen to collect.

CHAS. M. INGLIS, F.Z.S., F.E.S., M.B.O.U.

BAGHOWNIE, DARBHANGA, N. BIHAR,
6th August 1922.

No. II.—BIRDS OF MESOPOTAMIA.

To "The Birds of Mesopotamia" notes in your issue of June 30, I would like to add the following if helpful in any way.

(1) *Grey lag Goose.*

I observed these geese on the shores of the Hamar Lake at Legait pretty closely. I shot, more or less in the bare desert, 100 of these geese in a month and a half to my own gun—of which 74 fell to double shots (37 "right and lefts"). In

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may be of interest to record two consecutive shots from a 16 bore loaded with No. 6 shot, *i.e.*, one goose with the first barrel and two with the second—and then two with the first and one with the second—all flying. Nothing is claimed beyond the "fluke" of it.

I cannot bear out Magrath's statement of geese "roosting during the day well out on the bare desert." Surely geese roost at night and not in the day time? I found it their custom to return to the water about 11 a.m. to rest and wash before going out to feed again about 3-30 p.m. I found the geese at Legait frequenting the bare desert regularly in the mornings from dawn to nearly midday—and from about 3-30 p.m. to dusk for the purpose of feeding. I was much puzzled by watching them—as I have by the hour through field glasses—feeding readily on apparently bare sand; later I discovered that they cropped a fine grass from beneath the surface of the sand which explained matters. I have never heard of geese going inland to sleep before.

Has no one seen domesticated geese resembling grey lay geese very closely in Mesopotamia? I seem to remember them but cannot say for certain now.

The weight of these geese varied from 8-10 lbs. (*i.e.*, the largest were heavy birds of their kind).

(ii) *Purple Heron.*

Doubt as to its breeding in Mesopotamia is expressed. I had several young ones brought me at Hilla and kept some in my aviary at Musaiyib where they were very tame and used to sit on their "hocks" in an amusing way.

(iii) *Woodcock.*

I shot one at Musaiyib in a date garden—but cannot recall the time of year.

(iv) *Common Sheldrake.*

I have seen several pairs in the desert in May—just before they were breeding—and definitely found their breeding burrows on two occasions:—

(i) In the desert at Legait about ½ mile in from the Hamar Lake; and

(ii) In the desert between the Euphrates and Tigris in the Musaiyib district and a long way from water.

T. R. LIVESEY.

NO. III.—THE GAME ANIMALS OF INDIA.

I find Major Stockley's "Notes on Lydekker's Game Animals of India", in the Vol. XXVIII, No. 2, of the Journal, especially interesting in view of the fact that I contributed some five or six columns under the same heading to the *Asian* newspaper on January 22, 1901, on the appearance of the first edition of the book. In my Notes several of the matters referred to by Major Stockley were dealt with. I think the best account of the Gaur (Indian Bison) is that given by Mr. Inverarity in Vol. 4, No. 4, of the Journal, in 1889. My Notes above referred to point out that the Black Buck becomes more or less brown during the hot weather, and that the blackest hue is assumed during the rutting season, with which this form of coloration is probably connected. It was also remarked that it would be interesting to know whether a similar change of colour has been observed in other antelope, as for example the Blue Bull, but this does not appear to have been commented on elsewhere. In the Deccan some specimens of the Black Buck appear never to become black, and these are distinguished in the vernacular by the term "Bahmani." The finest head I have seen in the Deccan, with 24-inch horns, was from a buck almost as lightly coloured as a doe.

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I also noted the author's remarks on the Baluchistan Gazelle, and returned to this subject in the Journal for Vol. XVIII, No. 2, 1908. Dr. Lydekker questioned whether the Baluchi chikara is entitled to rank as a distinct race, but he gave it sub-specific nomenclature. The grounds for this were that the horns of the female were distinctly ringed, the dark portions of the face dark brown instead of rufous; and that the horns of the male are a little more curved backwards, and slightly more lyrate when viewed from the front. These reasons were combated in my Note in the Journal above referred to. I have observed that the chinkara of the Deccan has distinctly annulated horns, while the colour of the face varies with age, and the degree to which the horns of the chinkara are lyrate varies in individuals. So far as I am aware this question as to the Baluchistan animal being a separate race has never been cleared up.

But the most important question of controversy in "The Game Animals of India" was the statement that it was doubtful whether the Black Buck ever drinks, while it was stated that the Gazelle was believed by some observers, including Dr. Blanford, never to drink. On this I gave evidence in my Notes in the *Asian* to show that both these animals are addicted to drink, and this led to a controversy which lasted many years, although Dr. Lydekker in the end (vide *Indian Field*, August, 1910) acknowledged the correctness of my views, and said that if his "Game Animals of India" ever reached a third edition, he would modify his opinions on the subject. It is to be regretted that this distinguished naturalist did not survive to produce his third edition. An exhaustive monograph which I contributed to the Journal on "The drinking habits of wild animals," dealing with these questions, will be found in the Journal, Vol. XVIII, No. 2, 1908.

My experience as to the length of tigers and bears agrees with that of Major Stockley. The subject of the length of tigers has been discussed down to the last stripe, and there appears to be little more to say about it. I find that skins in my possession, which have not been unduly stretched, measure from 14 to 20 inches more than the animal measured immediately after death, when measurements were taken between uprights and not along the curves. I have shot some very large tigers, but none exceeding 9 feet 8 inches in length, including three feet of tail.

R. G. BURTON.

1*st June* 1922.

TO CONTRIBUTORS.

Will contributors when sending articles for insertion in the Journal help the Editors to prevent mistakes? The most fruitful source of "clerical" errors lies in the original "copy." If this were type written— and type written only on one side—and not sent in manuscript, many mistakes would be avoided. This is not a counsel of perfection; it is not meant to imply that if you do not possess a typewriter or the means of getting your articles typed you are not to send them in. Far from it—If you cannot send them in type, send them in in good plain legible script and then you can blame the editors for any mistakes.—EDITORS.

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MISCELLANEOUS NOTES.

No. I.—NOTE ON JACKALS (*CANIS INDICUS INDICUS*) ETC., IN A COMPOUND.

We have experienced a very hot May and all the water, except in the tanks, is dried up. In my fernery, a few yards from the bungalow, is a reservoir to which jackals, foxes, and mungooses come to assuage their thirst in the heat of the day. On account of this dearth of water all the animals are exceedingly bold and may be seen at all hours of the day, but more especially between ten and three, running or strolling about the compound. A fox (*Vulpes bengalensis*) is fond of sitting or lying down in the shade of a tall evergreen shrub with pale mauve flowers, about 30 yards from where I write; jackals are seen singly or in pairs trotting backwards and forwards across the lawn, and this morning about ten o'clock a pair of jungle cats (*Filis affinis*) stealthily and slowly slouched across the path with true feline gait.

About 1 p.m. to-day, while writing in the verandah, I saw a jackal chasing another across the compound. They went the full length of the ground and then turned and came galloping towards the bungalow, jinking around the shrubs. I noticed that the hair on the neck of the pursuing one was erect and that it carried its tail right over its back, while the hair on the other one lay flat and the tail hung down. I could see them very clearly as they charged right up to the verandah steps, in fact I thought they were coming in, but they swerved as they reached them. Although I was only some 2 or 3 yards distant they never saw me and went off. The pursuing jackal evidently lost the other one as shortly afterwards it returned on the scent, following the latter up all over the compound. I could easily recognise the beast as it was most repulsive looking, gaunt and mangy, a brute whose bite would be dangerous. What specially struck me was the different positions in which the tails were held. The jackals care nothing for my dogs, a spaniel and a small terrier, but stand and show fight when chased, much to the dismay and annoyance of the former.

This is the first year I have seen so many animals in the compound especially during the hottest hours.

Two otters (*Lutra lutra* ?) were killed by my coolies in a drain leading from my tank, but I did not know about it till the evening, when it was too late to save the skins for the Society, as the "dhangars" had consumed both.

CHAS. M. INGLIS, F.Z.S., F.E.S., M.B.O.U.

BAGHOWNIE, BIHAR,
26th May 1922.

No. II.—JACKALS ATTACKING A SPANIEL IN THE COMPOUND.

A day or so ago, my spaniel spied a jackal crossing the compound and rushed out at it. The jack stood to fight and the dog also stood, at a safe distance, and kept barking at it. In a few minutes a second jackal came from the direction of the fernery where it had evidently been having a drink and coming behind the spaniel made a snap at it. The first jackal then advanced to attack, but the dog considering discretion the better part of valour, bolted, yelping, to the bungalow.

I am certain had the dog been any distance from safety, both jackals would have attacked and killed it.

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Besides the cries mentioned by Blanford, the jackal utters a pure and simple bark of three or four yelps without any preceding wail.

Has any reason been assigned to the chorus of barks and wails given by jackals? Is it only a meeting of the clan?

CHAS. M. INGLIS, M.B.O.U., F.Z.S., F.E.S.

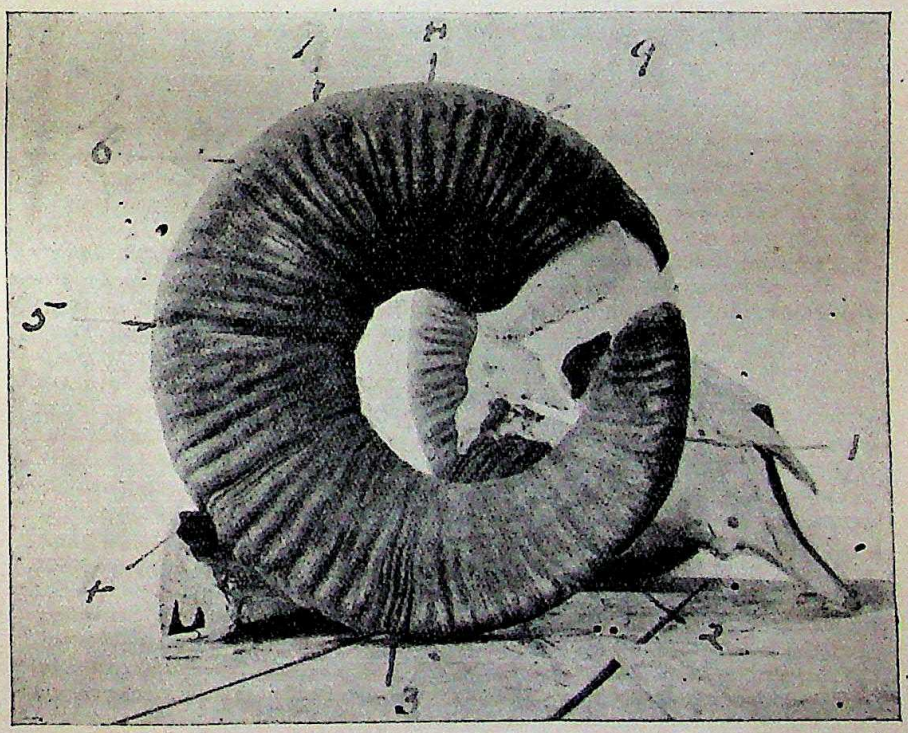
BAGHOWNIE, BIHAR,
10*th June* 1922.

No. III.—NOTES ON SOME SHEEP SHOT IN LADAKH.

(*With a Block.*)

When examining the horns of some sheep shot in Ladakh I was struck by the similarity of certain markings on the horns to the "stint," or winter, marks on scales of Salmonidæ.

As you are doubtless aware it is by counting these marks, caused by a check in development due to poor feeding, that the age of salmon and trout is now determined. From the very limited number of heads I have to work on (Two *Ovis hodgsoni* and three *Ovis vignei*) it seems probable that the markings alluded to



also show the number of winters which the late owners had survived, and give a close approximation to age.

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I send herewith a photograph of head No. 1 on the following list, which shows some of the marks well. Those that are indistinct on the right horn are clear on the left.

No.	Species.	Horn Measurement.	Winter or Stint marks.	
1	O. hodgsoni	45″	9	Much broken at tips.
2	Do. ..	38″	6	Do. do.
3	O. vignei	29½″	4 or 5	One doubtful.
4	Do. ..	28″	4	....
5	....	25¼″	4.	....

It is not probable that heads of *O. vignei* from low elevations would show the marks to the same extent, if at all, as should my theory be correct, they are caused by recurring periods of practical starvation during the severe winters of Ladakh.

RYAM FACTORY P.O.,
DARBAHNGA, BIHAR AND ORISSA,
23*rd May* 1922.

J. S. E. WALKER.

NO. IV.—NOTES ON MAN EATING TIGERS.

For some months past, a family of man eating tigers had been doing a lot of damage about 18 miles from here. Their excursions extended down a nullah seven miles or so long. We sent our head Jemadar to reconnoitre and he came face to face with 4 tigers, 2 of which he reported as being of a very light colour.

Three days later we shot 4 tigers out of the same jungle, and, extraordinarily enough, a big male leopard, 7′-9″, which at one portion of the beat climbed a tree evidently in fear of the tigers. We thought we had bagged all the tigers, but on examination found that two were full grown cubs, and two about three quarters grown. The two full grown cubs were of the ordinary colour and marking of a tiger, 1 male and 1 female. Measurements about 6′-6″. The three quarters grown cubs were unique and to me seemed pure albinos. They had pink eyes and were evidently in very bad condition because before being shot at they only trotted along like big dogs, whilst the other two galloped hard. Another peculiarity was the long neck, quite unlike that of any tiger or leopard I have ever seen ; one was a male and one a female. As it was dark we could not beat anymore but two days later got the mother, a fine beast in the prime of life and condition. Measurement 8′-9″. I forgot to mention the measurement of the freaks, *viz.*, 6′-0″. Such beasts have never been known of, or seen here, nor during the many shooting excursions my father (the late Maharaja Uripendra of Cooch Behar) made into Assam.

I should be glad if any of the readers of your Magazine could give me any definite information on the subject. Could it be possible that all four cubs belonged to the same litter ?

COOCH BEHAR,
3*rd May* 1922.

VICTOR N. NARAYAN,

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No. V.—SORE NECK IN SAMBHAR.

Your notes on the above in a recent issue of the Journal, seem to explain an experience of a mine in the Southern Province of Ceylon. Whilst shooting one morning I encountered a sambhar hind, in a narrow game path, which was apparently incapable of movement. On closely examining the animal I found that the under part of the neck was covered with festering sores over an area of several inches. The hind was otherwise in fair condition, but made several unsuccessful attempts to rise. At the time, I attributed it to a wound inflicted by a leopard, but as the sore appeared to be superficial, I think the theory of disease, more probable.

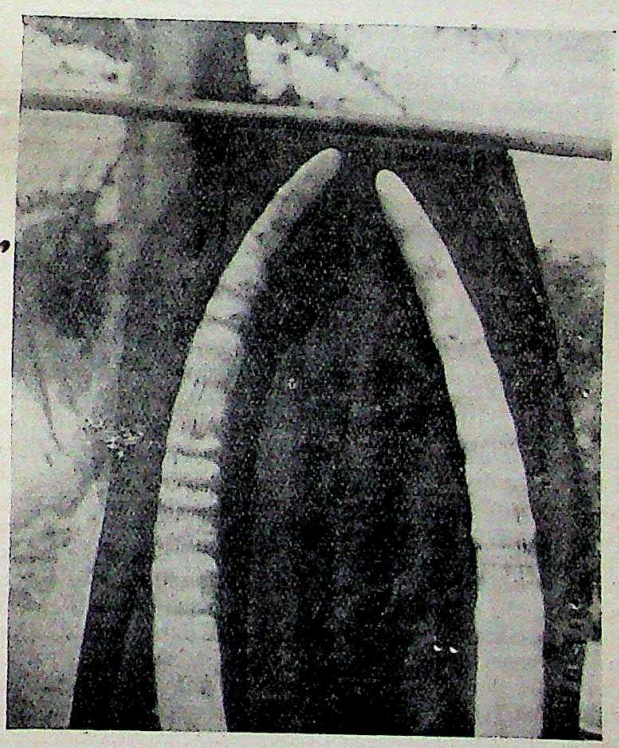
R. A. H. McCONNELL,
Lieut., R. I. M.

ADEN,
16*th May* 1922.

No. VI.—CORRUGATIONS ON ELEPHANT TUSKS.

(*With a Block.*)

I enclose a snapshot of a pair of elephant tusks I bagged in May, which I think will be of some interest to you, and I should be greatly interested if you could explain any reason for the corrugations on the tusks.



I have not heard of or seen a tame elephant which has this peculiarity, but heard of one other similar *wild* elephant being shot in the same district (Kele

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Valley, U. Chindwin R., U. Burma.) This type of "freak" tusk is apparently known to the Jungle Burman but as being very rare—they refer to it by a word meaning (sugar) "cane" which is corrugated in this fashion.

The corrugations are certainly not due to any rubbing on the part of the elephant, but are in the growth from the very root. I thought perhaps it was due to some disease when the elephant was young but the Burmans say no.

If you could account for it in any way I should very much like to know as may be you have seen similar tusks.

J. H. W,

RANGOON,
7th July 1922.

No. VII.—EFFECT OF STORM ON ANIMALS.

During the writer's visit to Mysore on the Prince of Wales' tour, a shikari friend told me the following incident:—

In 1912 or 13 the Colonel who narrated the incident said that he happened to be motoring through the jungle in the South of India. They had to make a stop on account of a thunderstorm. During the violent outburst nothing was to be seen of any of the denizens of the jungle, who were probably cowering away in the thickest depths, in great fear. Immediately after the storm had subsided, about 4 p.m. in the evening when the sun had broken through the clouds and its rays were making all the beautiful trees, rendered doubly green by the sudden outburst of the rain, scintillate and glitter in the way one often sees them do at home after a June thunderstorm, they proceeded on their way. The whole road became one mass of animals. The sides were thick with every imaginable kind of jungle animal ranging from a panther to numerous members of the *Cervidae* and smaller mammals, and numbers of peacock and jungle fowl. They were all sunning themselves in the space cleared in the jungle on either side of the road. The Colonel had often done this journey, but this was the only occasion on which he had seen the place 'swarming' with wild life. I wonder if other members have had similar experiences?

BERNARD C. ELLISON, C.M.Z.S.

BOMBAY NATURAL HISTORY SOCIETY,
June 1922.

NO. VIII.—NOTES ON OORIAL.

Life history.—Oorial are typical wild sheep, giving birth to one or, very occasionally, two lambs every year.

I take the period of gestation to be 5½ months, not six as is usually stated. I base this statement on the following observations. I have never seen any signs of the commencement of the rut in September. In the second half of September 1910 I was hunting oorial in the Shahpur district and right up to the end of the month the old rams were apart from the ewes. I then crossed the Indus and hunted markhor in the hills West of Kalabagh up to October 10th. There were oorial there also (I shot one ram) and no sign of the rut commencing. I returned to Massan and hunted oorial for a week in a jagir in the Talagang district and on October 17th I saw rams fighting and next day saw five rams chasing a ewe in season. In the third week of October 1920 I was in the Nili rukh (Jhelum district), and the rut was in full swing. In November 1919 I was in the Kala Chitta Range (Campbellpore district) and saw four rams chasing a ewe on November 19th. I have frequently been on oorial ground in early December, and the rut

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has always been finished by then ; the old rams having mostly separated into small parties unaccompanied by ewes. It seems certain therefore, that the rut falls normally between the first week of October and the last in November. The present close season is therefore based on, zoologically, incorrect data.

I have always seen the first lambs in the first week in April and some are born in the first half of May. The period of gestation therefore appears to be 5½ months.

Ewes are said to come into bearing in their fourth year, but it is possible that the third year is correct. Data on a point like this are very hard to obtain, and observations based on animals in captivity are not always applicable to wild animals.

It seems certain that a ram is not fully mature till his eighth year, at which age his horns should measure from 24 to 27 inches according to the conditions of grazing in his youth.

I would here emphasise the fact that oorial are grazing and not browsing animals, and that during the recent drought the want of grass was a strong factor in the reduction of their numbers.

Preservation.—It has always been found that on grounds where the old males have been shot off, that the heads never recover their strength, even with several years complete preservation. *e.g.* Red deer in Scotland and ibex in the Sind Valley in Kashmir. Once the immature rams have no difficulty in obtaining ewes, the stock weakens. There are at present a few old rams amongst the oorial, and a very promising stock of five to seven-year-olds. If these old rams are killed off now the stock born next year will be weak and a danger to the race. Then, if as they mature, the others are killed, the competition for ewes will cease and the race may even die out altogether.

A possible alternative to complete cessation of shooting for five years is closing for two or three years and then reopening to limited shooting with a higher size limit : I would recommend 26 inches. Nature has a way of compensating for the unusual, and it may be found that next spring the ewes will mostly have born twins instead of the usual single lamb.

As far as relative damage by sportsmen and villagers is concerned, it must be remembered that the modern young officer has still to be educated in the ethics of sport and the principles of preservation. There is a great deal of poaching carried out by Europeans in rukhs near the railway : notably Nili and Lehri Godari. I heard of three British officers basing their operations on Tarki railway station in the middle of last October, and killing 14 rams between them. I have personal knowledge of two other cases when officers from Rawalpindi motored to Schawa and shot oorial under direction of a doctor (or veterinary officer) of a camel corps stationed there, he himself having no license. I found that much of this was due to ignorance of the shooting regulations, and after getting the Commandant of the Musketry School at Rawalpindi to post a notice on the subject, the practice ceased to a large extent. When I was in occupation of Nili rukh in the first half of December 1920, I twice saw Europeans shooting in my block, but was unable to come up with them on either occasion.

I would suggest that the regulations on the subject be posted in every club.

Villagers' dogs are a fruitful source of damage, as they chase ewes heavy with young, and frequently destroy the new-born lambs. I recommend their absolute exclusion from rukhs.

The occasional visit of a sportsman to a rukh is an excellent thing, as it often reveals an outbreak of poaching or of slackness of a watcher, and certainly acts as a deterrent. During the war the game in the remoter portions of Kashmir is reported to have decreased considerably owing to the want of any check on the Game Watchers and the consequent increase of poaching.

The proportion of rams to ewes should be about 50 per cent. of all ages : this gives about 10 ewes to every fully mature ram. Any increase of this

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proportion should be dealt with by the shooting of a ewe before each ram is killed. Complaints as to destruction of crops would be met by such a regulation. There is no doubt that such complaints were justified in some few localities before this last disastrous season.

Since writing my first letter on the subject to you, I had a conversation with a big land-owner of Jalalpur, whose name I unfortunately cannot remember. He told me that the oorial in Jalalpur rukh had not suffered much from the drought, as they came down to the Jhelum to drink. This rukh is peculiarly situated, however, and I can think of no other with such advantages. The reports I have had from other rukhs are most depressing.

C. H. STOCKLEY, D.S.O.,
Major.

STANYON'S HOTEL, QUETTA,
3rd October 1922.

No. IX.—THE BREEDING OF ELEPHANTS IN CAPTIVITY.

I have read with great interest Mr. Hundley's letter of 30th August 1921, given in the last issue of the journal received by me.

I have kept a record extending over a number of years and put the period of gestation at 22 months. An elephant may calve after 20 months, but if she does it is due to over work or over marching and the calf if born living will at first be weaker than a calf carried for the full period. More usually it is born dead.

My records comprise cases when I have seen the act myself and also cases when I know that a cow elephant has been covered by a bull within a period of a very few days.

It is not necessary for the bull elephant to be "musth" to reproduce his kind and in fact a calf can be got by an immature, still growing, bull, which has never been on "musth."

Among wild elephants a young bull would be driven away by the bigger tuskers and also in cases where a number of tame elephants are working and grazing together.

I differ from Mr. Hundley when he states that "musth" has little to do with the sexual instinct. Bull elephants on "musth" always become queer tempered at that time and many very dangerous both to men and to other elephants and have to be tied up and starved until "musth" abates.

If a cow in season can be provided for the bull it will tend to reduce his "musth," but he will drive away and even gore a cow which is not in season and will therefore not allow him to cover her.

We had a case only last April in our elephant rest camps, when a tusker—a dangerous man-killing beast even when sane—went musth and got loose without his hobbles. My two travelling elephants were fortunately close at hand and more fortunately still both in season. He covered them both repeatedly which so reduced his "musth" that our men were able to recapture him. He was then tied up and in spite of starvation his "musth" increased for some days and he would have nothing to do with another cow introduced to him.

A cow elephant in season will very often have a slight discharge from the glands between the eye and ear, similar to the discharge from a "musth" bull but of course to a very much less extent, in fact merely a slight dampness visible when the skin of the elephant is dry.

A bull going "musth" usually gives fair warning of his approaching condition by the glands of the temple swelling some days before the discharge commences

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In a wild state, judging from cases I have known of wild tuskers coming down to worry our tame herds and occasionally inducing a tame cow to elope with them, "musth" usually comes on at end of December or in January when vegetation is at its best, but in tame herds, which are generally worked till the end of February, "musth" does not come on till later, after the elephants have had time to pick up and get into good condition.

There is something radically wrong with any mature bull which does not come on "musth" at least once annually and if looked into the cause will be found to be ill-health or more usually over work which may have taken place one or even two years before. To my mind the only cure in either case is complete rest in a good grazing area for six months, a year, or even longer, though tonics may assist matters a bit.

J. C. C. WILSON.

MAIHONGSONG, SIAM,
19*th July* 1922.

No. X.—FURTHER NOTES ON TRAPPING.

In some earlier notes I attempted to describe my impressions of trapping in heavy jungle and at the time of writing them was of the opinion that trapping under these conditions was the most trying pastime imaginable, wherein I was sadly mistaken, as the first day's trapping in open country forcibly showed me, and which I shall now try and describe.

Imagine for your setting then, any part of the Plains of India, as plain as your imagination can run to.

A cursory inspection on arrival had shown me a number of things of interest to the collector, such as the fact that every ridge dividing one field from another had a number of rat holes and runs along it, and that almost every suitable bush had a rat or mouse hole at its roots. This gave me a fair idea as to where the traps had best be placed, and I set out accordingly with a light heart to do so. Selecting a ridge that had a fair number of thorny stunted bushes growing on it I started to set traps or, I should say, nearly started, for, as I bent down to examine a promising looking rat run, I noticed a man, at work with a plough not 50 yards away, gazing at me intently. That rather spoilt that ridge, but nothing daunted, I started for an equally promising looking one some way off. When I was about half way there a goat-herd appeared like a phantom from behind a bush that didn't look big enough to conceal a quail. "That's that" said I, and thanking providence and the local ryots for having arranged a liberal number of ridges per square mile, I made for another. "At last" I thought as I drew near it, "I'm safe"; just then a hare got up and offered me a very tempting shot which I took, this had very little effect on the hare, but drew excited exclamations from four urchins who I found had been following me unknown to myself. I turned on them and shouted to them to "Jao" and they responded vigorously. I then decided on a ridge in the distance; and towards it I made, walking in a manner I reckoned should arouse little or no suspicion. I passed two boys en-route and was glad to see that they did not seem to be aware of my existence. On reaching the ridge I had a good look round to satisfy myself that I was not being watched and, seeing no watchers, started to set traps. I had just set my third, when my skinner who was with me touched me on the shoulder and pointed, and, following the direction his finger pointed to, I saw a head bob up and then as rapidly down again behind a bush. I felt like putting a charge of No. 6 shot into it but refrained from so doing. Now, being evening, time was an item not to be ignored, and knowing this I was getting irritable, but as a last venture I decided to make for a deserted garden that looked as though it couldn't possibly hold more than rats, mice and cobra. I got into it and searched

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all round for watchers, and being convinced of their entire absence, started yet again to set traps. I got all bar three set when I noticed an Indian come quietly into the garden so I wended my way homewards deciding to set the remaining traps near the Bungalow. The marking of the spots where traps had been set, with bits of paper or rag was as my readers will easily see highly inadvisable under the present circumstances, so I had not dared to do so, and the next morning the fun started at the commencement of our search for traps. My skinner and I both selected a different ridge as being the one on which the first traps had been set, and had not a Neophron tearing at something, that proved to be a trapped Gerbril, on a ridge some 50 yds. away led us to the right spot, we might still have been searching for those traps. Of that lot I found the last set had vanished, the urchin whose head I had contemplated filling with No. 6 shot no doubt having borrowed it. In the deserted garden I found one trap stolen by my visitor or so I presumed. News, and especially such news as "Good rat and mouse traps to be had for the asking" travels fast in India, and the next day I found a group of eager looking urchins loitering near the Bungalow in order to be able to join me from the start. Close scrutiny of this sort is very hard on one's nerves and compels one, in trying to set traps without being seen, to behave in a manner usually associated with a lunatic with homicidal tendencies, which you will agree is infra dig. I strongly advise anyone contemplating trapping in the Plains of India therefore to think twice.

After such an evening as that just described it is most annoying to pick up the Gazetteer and read something of this sort, "The population of the District is scanty, the average for the whole being approximately 1·01739 per square mile" but then when were figures and facts found to agree on comparison and what is there to prevent a decimal having been erroneously inserted in the printing?

Sept. 1922. C. PRIMROSE.

No. XI.—THE COMMON INDIAN BEE-EATER. (*MEROPS VIRIDIS*)

Last month I opened a Bee-eater's nest at the end of a tunnel three feet long and found the young ones hatched out but not fledged. In the hope of saving them I made an artificial tunnel of country tiles with stones laid over them. At first the parent birds kept flying to the mouth of the tunnel and going away but at last the persistent calls of their young ones were too much for them and they essayed the great adventure and went in. After this they went in and out quite happily and the work of bringing up the family proceeded in the normal manner. I imagine they would have deserted the nest if the eggs had not been hatched.

BHUJ, CUTCH,
30*th June* 1922.

E. O' BRIEN,
Lt.-Colonel.

No. XII.—NIDIFICATION OF THE CEYLON THRUSH (*O. IMBRICATA*).

With reference to my note on *O. imbricata* breeding in Ceylon published in Vol. XXVIII, No. 2, pages 546 and 547, I was unable to obtain an egg drill and blower (mine having been lost during my absence on War service) so had to resort to the old pin method by making a hole at each end. The egg was very much incubated and I regret to say it got rather badly broken, though I did manage to patch it up. I continued to watch the nest daily, being anxious to obtain notes of the plumage of the nestling, etc. The bird sat on her solitary egg for literally weeks and I began to suspect that all was not well. During one of my daily visits I found the bird off the nest and on examining the egg discovered

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a small hole in it and the ants hard at work cleaning it. The hole looked as if, the bird, becoming fed up with such a long sitting, had punctured it herself to see what was wrong, and finding the egg a 'dud' had left in disgust. I had no difficulty in cleaning it as the contents simply ran out and besides the ants had cleaned about half of it already. I sent the whole nest and both eggs to the Colombo Museum where they now are but my conscience has pricked me ever since that I did not send them to you, still, after all, charity begins at home. I took my first egg, which as I mentioned was very much incubated, on 9th August 1921, and the second egg on 3rd September 1921 so that wretched bird was sitting for over a month. . The curious part was that they started building again within 200 yards of the old site on the 30th September 1921 in a Dadap (shade tree) this time about 20 ft. up, and on visiting the nest on 1st October found the bird on so did not disturb her. On 2nd October the nest contained one egg exactly similar to the last only not quite so clouded with brown wash at the large end. I unfortunately was prevented from visiting the nest for about 5 days and when I returned, found it had been robbed and pulled down by coolies. I am convinced it was the same pair as I only know of one pair in that particular spot, though I have seen one or two more birds in an entirely different part of the estate. The birds are still there and I hope to get another nest this year. During the dry weather, when most of the leaves had fallen off the albizzias I found no less than three old nests which goes to prove that I have hit upon their usual breeding locality.

T. E. TUNNARD.

DANDUKELAWA, HATTON, CEYLON,
24th May 1922.

No. XIII.—NIDIFICATION OF THE CEYLON ARRENGA (*A. BLIGHI*).

On March 30 of this year (1922) I found the nest of *Arrenga blighi* containing one egg on the point of hatching, the shell being already cracked, so needless to say it was useless taking it. I was climbing up a steep rocky ravine on the hunt for this particular nest when I saw one of the birds fly out from under a projecting ledge of rock. I could not reach the place from the same side so had to cross a slippery face of rock and then recross again higher up stream in order to reach the spot from where I saw the bird fly out. I had on rubber soled shoes which are excellent for dry rock climbing, but worse than useless where the rock is at all wet. I first of all tried bare feet but that was as bad as wet rubber so put on my stockings and managed to crawl across on these, finding that wool grips quite all right on wet rock. There was the nest, about 7 ft. up, built on a fairly wide ledge under another projecting ledge of rock and quite sheltered from rain or any drips from above. The nest was a large, but neat and compact, structure composed entirely of moss and lined with fine fern roots. The egg a rather broad oval with a large and small end fairly smooth and glossy. The ground colour whitish green with a few faint brownish streaks distributed over the large end only. I fancy that one egg is the maximum laid (compare previous and only Ceylon record, E. Green, Tabrobanian, 1887). Close to this nest on other ledges of rock I found three old nests of previous years in good preservation owing to their being placed in sheltered spots protected in each case from rain.

Amongst uncommon Ceylon birds, I have seen here Legges Flowerpecker (*Acmonorhyncus vincens*) and the Red-Winged Crested Cuckoo (*Coccys es coromandus*). The latter on migration on 12th January of this year.

T. E. TUNNARD.

DANDUKELAWA, HATTON, CEYLON,
24th May 1922.

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No. XIV.—OCCURRENCE OF THE DESERT LARK (*ALAEMON DESERTORUM*) IN THE PUNJAB.

I am not aware that the occurrence and breeding of the Desert Lark has been reported from the Punjab. Neither in the Fauna of India, Birds, nor in Hume and Oates' "Nests and Eggs of Indian Birds" is the Punjab mentioned. The following may therefore be of interest.

On the 18th current, accompanied by my wife, I was looking in the desert country west of this place for possible nests of the Spotted Sandgrouse, when my wife called my attention to a curious nest that she had just found. It was like nothing that I had ever seen before, and there was no bird on, or near, it. It was late in the afternoon and we waited as long as we could afford to do, but no bird came, though there was one egg in the nest. We left and returned two days later.

On this occasion I found a bird sitting. Our approach was not very quietly made and the bird got up. I felt sure that it was the Desert Lark, and so it proved, after full investigation, to be. There were now three eggs in the nest, which was placed in the middle of a vast expanse of perfectly bare, hard, dry *pat* under a small, bare, naked branch which had got stuck in the ground on some occasion when there was rain. There was the "layer of small branches," or twigs, mentioned by Lt. Francis in "Nests and Eggs", about a foot in diameter; it did not however raise the nest above the ground so much as make a fringe all round the nest. There was also the deep cup, lined in this case with wool and a little fine grass. The nest was indeed "very conspicuous," though the odds against any human being finding it in this great desert space were long. I let the sitting bird run away in order to use to the full the time at my disposal for observation. Her Plover-like appearance (I take it this was the female, though, unfortunately, the underparts were, later, too damaged for certain identification of sex of the dead bird) and china-white, long, legs struck me at once. Once off the nest, the bird was wary, and her behaviour on this occasion was unlike that of Lt. Francis' bird, so after following for a bit, I decided to wait at a distance till she should return. I then became aware of a loud melodious call, something like "*tee, tee, tee*" followed by a trill reminiscent to one long absent from England of the trill of the Nightingale. I looked round and saw another and similar bird, evidently the mate of the one I had disturbed. At times he ran, and once I saw him climb into the air for about 30 feet and almost *tumble* down again, the white, grey and brown of the upper wing and the silvery wing-lining being very conspicuous in these aerial movements. The call was repeated several times, but out of one corner of my eye I was looking at the nest, and the original bird was now returning. I followed her and this time, my approach being more cautious, she let me get within six or eight yards of the nest, seeming to hope that she would escape notice. Rather reluctantly she left, and I had no difficulty in shooting her.

On examination, the specimen I secured measures 8.5" with a wing of a little less than 4.5." I note that the "Fauna" says the females are much smaller than the males, and that the maximum length given is 11". My specimen seems paler than normal, the outer tail-feathers and the primaries being very much more brown than black.

The eggs in this clutch vary rather in markings, one being more profusely speckled, and with the speckles lighter in colour, than the other two. The colour is as described in "Nests and Eggs."

R. C. BOLSTER, I.C.S.

DERA NAWAB, BHAWALPUR STATE, PUNJAB,
20th April 1922.

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No. XV.—EASTERN SOLITARY SNIPE SHOT AT NALBAN ISLAND, CHILKA LAKE, ON THE 16TH DECEMBER 1921.

While out duck shooting with Mr. T. McDonnell of 9, Theatre Road, Calcutta, at Chilka (Nalban Island), I flushed and killed a Solitary Snipe. As duck were fairly plentiful and flighting well at the time we did not trouble to fire at snipe. These were very plentiful and were being flushed almost every time we moved. This particular snipe however first attracted my attention by its loud cry. Then, noticing its large size, I shot it. (No. 5 shot, Smokeless Diamond).

Mr. McDonnell identified it as *G. solitaria* and informed me that Mr. James Smythe of Calcutta had flushed several in the same locality in X'mas, 1920.

We spent 3 days on the Chilka Lake and although we flushed and killed numerous Fantails and Pintails we saw no more Solitary Snipe.

Unfortunately I did not skin and preserve my specimen as I then did not realise that it was so rare on the Chilka. I guess it weighed between 6 and 7 ounces. There were 18 tail feathers. Legs were olive green.

I have no doubt that Mr. McDonnell's identification was correct.

H. B. TILDEN.

CARLTON HOTEL,
BOMBAY, 9*th May* 1922.

No. XVI.—IS THE DHAYAL (*COPSYCHUS SAULARIS*) A MIMIC?

Legge says of *Copsychus saularis*, "Its power of imitation is considerable, tempting it to mock the voice of fowls and other birds in the vicinity of its domicile" (*Birds of Ceylon*, p. 435). To illustrate this habit of mimicry in the Magpie-Robin, he has quoted an anecdote related by Layard. The latter's observation is that even in freedom the Dhayal can mock to perfection the voices of other creatures. If this observation be true, the birds' behaviour appears quite singular, for even the parrots, which are past-masters in the art of mimicry, do not exhibit their apish propensity in their wild life.

It is very strange, however, that all the writers on Indian birds are silent on the Dhayal's power of mimicry. We find nothing about it in the works of Frank Finn, Jerdon, Eha, Dewar, and Dalgliesh. Even the *Fauna of British India* does not touch the point. On the other hand, Gould, in the *Birds of Asia*, Vol. III, states positively that this bird is not "degraded by apish tricks of imitation." My own aviary has harboured Dhayals for a long time, but no effort on their part to mimic the voices of their mess-mates has come to my view. I am anxious to know if any of the readers of this Journal has any experience of the above trait in the character of the Dhayal. Information on this point through the medium of this Journal would certainly add to our knowledge about the behaviour of the bird.

SATYA CHURN LAW.

No. XVII.—DESCRIPTION OF CHICK OF THE BENGAL FLORICAN (*SYPHEOTIS BENGALENSIS*).

In a notice on Mr. Stuart Baker's game birds, published in the April number of the Ibis, there is the following remark:—"Of the remaining Bustards, more especially the Bengal Florican, *Sypheotis bengalensis*, complete accounts have been given and we are surprised to find that apparently the chick of that species does not appear to be known."

I am very certain that I sent Mr. Stuart Baker, when at Dacca, a series of Bengal Florican skins, including that of a chick, which I had acquired; but as he

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has not described it and, from the above notice, it presumably being undescribed, I do so now.

Description.—Above and below warm rufous buff. Crown rufous mixed with rufescent brown and bordered by a stripe of the same colour from each side, meeting behind at the nape and continuing partly down the back of the neck; ear-coverts bordered with rufescent brown; back and wings mixed rufous buff and rufescent brown; a patch of rufous bordered by rufescent brown from lower neck to breast and a patch of rufescent brown on each side of the breast; thighs with three broad rufescent brown bands on outer sides.

"Irides hazel brown" (A. M. Primrose). This was collected by Mr. A. M. Primrose in Goalpara on the 12th June 1916.

BAGHOWNIE LAHERIA SARAI, BIHAR, *9th June* 1922.

CHAS. M. INGLIS, M.B.O.U., F.Z.S., F.E.S.

No. XVIII.—OCCURRENCE OF THE BLACK THROATED DIVER (*COLYMBUS ARCTICUS*) IN INDIA.

It is worth recording the fact that on February 19th, 1922, I shot a specimen of the above species on the Western Jumna Canal at Jagadhri, Ambala District, Punjab.

Soon after daybreak on this date I had gone up the left bank of the canal after some Pintail duck which I had seen alighting in the shallows some half mile above the railway bridge. I may mention that the canal here partakes more the character of a river inasmuch as the banks on either side are very irregular and on this particular day the water was very high, having in places inundated some extent of the adjacent low ground which usually is simply rush-covered mud, the haunts of *Prinia flaviventris*, *Cyanecula suecica* and *Centropus sinensis*. I mention these details because the Pintail usually do not settle on the canal proper, but finding this inundated patch suitable as a resting or feeding place they had congregated there in some numbers, and had it not been for this fact I should have gone in the opposite direction.

Having dealt with the duck, I was returning to the bridge when I saw this bird fishing near the bank. Waiting for it to dive I ran up and just before it reached the surface I could see the small fry leaping clear of the water before it's approach. As soon as it appeared clear on the surface I shot it.

Mr. Hugh Whistler, who kindly examined the specimen for me, in confirming my identification, tells me this is the first occurrence in India, adding that it is also the most southerly record, at the same time he adds in epist:—It apparently belongs to the race *Colymbus arcticus suschkini* (Sarudny), which according to Sarudny is found in Mongolia (Kobdo), Tomsk, the provinces of Ufa and Orenburg, the Kirshis Steppes and Western Siberia to the Yenissai.

Dissection proved it to be a female and Mr. Whistler is of opinion that it is a first winter bird.

There was very little fat on the specimen.

Colours of soft parts:—Irides red brown; bill livid grey, culmen dark brown; tarsi and feet dark leaden on upper surface, remainder livid grey.

Measurements:—

Wing	290 mm.
Tarsus	73 ,,
Bill from gape	83 ,,
Do. from skull	79 ,,
Do. from posterior margin of nostril	51 ,,
Do. depth at commencement of feathering ..	17 ,,

SIMLA, *20th April* 1922.

A. E. JONES.

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No. XIX.—OCCURRENCE ON THE NILGIRIS OF A PARTIAL ALBINO OF THE SOUTHERN INDIAN SCIMITAR BABBLER (*POMATORHINUS HORSFIELDI TRAVANCORIENSIS*) (HARINGTON). F. B. I. No. 120.

On the 29th June of this year, Mr. G. Oakes of Downham, Kalhutty Sigur Ghat, Nilgiris (elevation 5,500 feet), very kindly sent me a pair of these birds, shot in his fruit garden. One was the ordinary type, the other was a partial albino of which the following is a description:—Length 8·5″, wing 3·5″, tail 3·5″, tarsus 1·25″, bill from gape 1·2″. Bill orange yellow, the nostrils and a small portion of the basal part of the upper mandible greenish, legs and feet pale leaden blue, soles and claws yellow, irides red-brown. The whole lower plumage from the chin pure silky white, upper plumage, including the head, white streaked in places with pale brown, primaries and secondaries white faintly edged externally with pale brown, tertiaries white, rather broadly edged on both webs with pale brown, tertiary coverts darker brown with white tips, the other coverts pure white, tail white, with some of the feathers edged with pale brown.

PROSPECT LODGE, OOTACAMUND,
NILGIRIS,
30*th June* 1922.

H. R. BAKER,
Lt.-Col., I. A. (*Retd.*)

No. XX.—BREEDING OF THE INDIAN PITTA (*PITTA BRACHYARA*) AND THE STREAKED WREN WARBLER (*PRINIA LEPIDA*).

In Vol. XXVIII. No. 1, Mr. R. C. Bolster, I.C.S., has notes on these two species. As I have had some experience of them, I venture to give this now.

I have not access to my Natural History Magazines, but I know I published notes in them regarding the Indian Pitta. This bird is fairly plentiful on the Ghats near Mhow, Central India, during the monsoon. In 1909-10, I took many nests through June and July. I was commanding at Dehra Dun in 1919, where the Indian Pitta arrived in June, and on the 17th of that month I obtained 4 fresh eggs from a nest in a shady nullah not far from the Body Guard Lines. As I had a fairly good collection of eggs of this bird, I did not worry much about them. The impression I formed was that, although it was fairly common during the month, most birds moved further on to breed for I found no more nests. As they are most conspicuous, had they been plentiful they could hardly be overlooked. As regards the Streaked Wren Warbler (*Prinia lepida*) I found many nests during 1916-17, when quartered at Ferozepore and Lahore. The majority during July. The earliest date recorded is, however, 9th April 1917, and the two latest 9th and 10th October 1916.

I have had very similar experiences to those of Mr. Bolster regarding the "Destruction of Birds' Nests" and am at a loss to account for them. Mynas, Tree pies, Crows, Coucals and Shrikes, I know are not above suspicion, but there are many other enemies to small birds.

CAPE TOWN, SOUTH AFRICA,
15*th March* 1922.

R. M. BETHAM,
Brig.-General.

No. XXI.—CURIOUS SITE FOR NEST OF THE BENGAL RED VENTED BULBUL (*MOLPASTES HAEMARRHOUS BENGALENSIS*).

As is well known these Bulbuls *usually* nest on trees and bushes but a pair here have built a nest under the eaves of a thatched roof. The nest is placed resting

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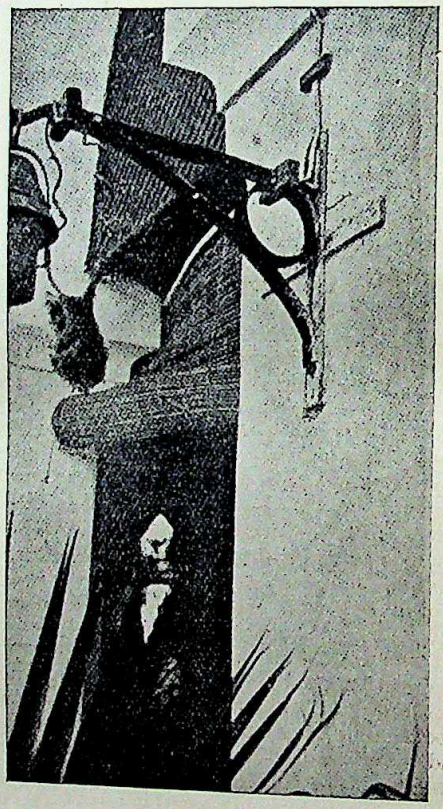
on one of the bamboo *butties* and between it and the thatch; as the house is low roofed and the eaves come well over, the nest is exceedingly well concealed and but for the bird flying out on several occasions when I passed the house I should never have noticed it.

BAGHOWNIE LAHERIA SARAI, N. BIHAR,
7th August 1922.

CHAS. M. INGLIS,
F.Z.S., F.E.S., M.B.O.U.

No. XXII.—CURIOUS NESTING SITE CHOSEN BY THE PURPLE HONEY SUCKER (*ARACHNETHRA ASIATICA*).



I send you a photograph shewing a peculiar nesting site chosen by the Common Purple Honey Sucker. As you will see from the photo the nest is attached to the wire carrying the current and is within a few inches of the lamp itself. The lamp is suspended by a bracket placed at the entrance of the Officers' Club, Ajmer, and is alight from sun down till past 9 p.m. every night.

Eggs were actually laid in the nest and would probably have incubated in the usual course but some well meaning member thinking the nest required strengthening tied the upper portion to the wire with string.

This was apparently too much for the parent birds who deserted.

AJMER,
17th June 1922.

W. E. SHIPP.

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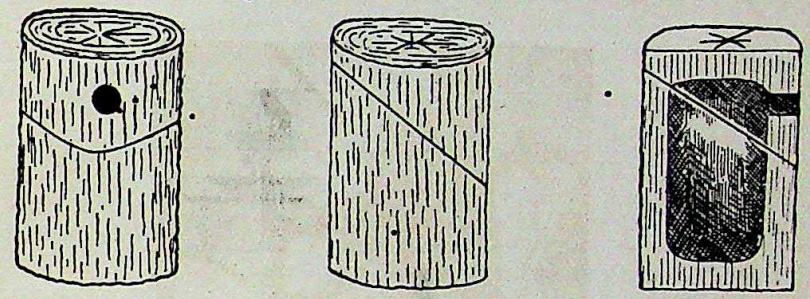
No. XXIII.—WOODPECKER OCCUPYING NESTING BOX.

Early in the spring this year I prepared a number of nesting boxes, in hopes of attracting birds, especially tits or nuthatches, and of inducing them to breed in my compound in Pachmarhi. The boxes were constructed as follows:

Diagrams to illustrate method of construction of nesting-boxes.



FRONT ELEVATION. SIDE ELEVATION. SECTION.

Cylindrical sections of a young tree, about 9 inches in diameter with the bark on and about 15 inches in length were prepared with a cross cut saw. Each such cylinder was then cut across again, diagonally, into two unequal halves as shown in the diagram, the smaller half to constitute the lid of the nesting box.

Both halves were then hollowed out with a stout auger and goudge, giving a cylindrical hollow 5 inches or so in diameter and 10 or 11 inches long, a thickness of 2 inches being left at top and bottom of the cavity.

A circular hole 1¼ inches in diameter was then bored through the longer side of the lid section, communicating with the central hollow.

Two stout headless nails were then driven into the margin of the lower half of the cylinder on opposite sides of the hollow and in a vertical position protruding about an inch above the level of the surface of the wood, and two corresponding holes were bored with a gimlet in the rim, at the base of the lid portion. The lid could now be firmly fitted into the basal portion of the cylinder and could be easily removed and replaced again with no danger of its falling off.

The nesting boxes were then hung up against the trunks of trees about 15 ft. from the ground, with entrance hole facing outwards. This was done early in February. Towards the end of February a pair of Golden Backed Woodpeckers (*Brachypternus aurantius*) became interested in one of the boxes; but the entrance hole having been made small (to exclude mynahs) they set to work to enlarge it. Eventually they enlarged the hole to 2¼ inches diameter and finding the cavity inside quite suitable for nesting purposes they adopted it without further excavation.

On March 9th the nest contained 3 fresh eggs, pure white of course but pink from translucence. Incubation commenced the same day.

From this date onwards I examined the nest daily and the birds gradually became accustomed to my visits. They always left the nesting box, however, on my commencing to climb the tree. The following notes are from my diary.

March 19th Eggs not yet chipped.

„ 20th All three eggs hatched. The young are quite naked. The upper mandibles are tipped with a conspicuous white shining scale.

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A similar but smaller scale is present on the tips of the lower mandibles. One of the young birds opened its mouth for food and made the characteristic rattling sound of young wood-peckers.

March 21st No important change. Nestlings still quiet naked but stronger. The elbows of the legs have a peculiar swollen comb-like serrated appearance behind.

„ 22nd Birds still naked. One is only about half the size of the others.

„ 23rd No great change.

„ 24th Only two birds in the nest. The small one must have died and been removed by the parents.

„ 25th Young birds growing rapidly. Otherwise no change.

„ 26th „ „ „

„ 27th Eyes just opening. Also feathers and quills just beginning to show.

„ 28th Feathers developing, especially a curious band or strip across the thigh.

„ 29th Further development.

„ 30th A tinge of red appearing on crown.

„ 31st to April 3rd. Steady development in feathering.

April 4th Red caps and orange backs conspicuous.

„ 5th to 8th Gradual full development of feather tracts. Birds very noisy.

„ 9th Both birds left the nest.

The nest box cavity was not enlarged by the parent birds. It was throughout kept scrupulously clean. This surprised me as I always understood that the removal of the fæces of the young was performed by Passerine birds only.

No droppings or dirt of any kind were found in the nest until the last day before the birds left the nest.

The young never returned to the nest after leaving it.

B. B. OSMASTON, C.I.E., I.F.S.

GULMARG, KASHMIR.

No. XXIV.—NOTES ON THE NESTING OF THE HIMALAYAN TREE CREEPER (*CERTHIA HIMALAYANA*).

The following note on the nesting of the Himalayan Tree Creeper (*Certhia himalayana*) may be of interest. Blanford, in the Fauna of British India, and also Hume, in Nests and Eggs, state this bird nests high up in tall trees, 40′ to 50′ from the ground. I have found three nests of this bird here, and they have all been quite low down near the ground. It is an early breeder, March and April, at least they must commence building in March. I had no experience of this bird's habits, so judging from the above authors' notes I spent hours watching them in hopes of discovering their nests, but failed to see them breeding till by accident I discovered the nest.

On the 19th April I was sitting in the shade of a pine tree, when two creepers flew on to the next tree, each with an insect in its bill. They were much excited, peeping at me round the trunk of the pine, then one bolder than the other, flew down to the tree I sat near, and disappeared round the trunk. A few seconds later it went off without the insect, and shortly after the second bird did the same; when they had left I examined the trunk and found a large piece of the back was detached from the stem, and on touching this to look behind, it came away disclosing the nest of 3 nearly full grown young ones. They all flew out, and there was also one adled egg. I replaced one chick, the only one I could find. The nest was situated only 2 ft. from the ground and composed of a few

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soft feathers, etc., placed on top of coarse material such as dark chips and other stuff to fill up the cavity.

The 2nd nest was in a nearly similar situation behind the partly detached bark of a dead cherry tree, about three feet from the ground and of like materials. This nest was also discovered by seeing the parent birds feeding their young. After the young had flown (I did not like to examine the nest for fear the chicks might be too young to fly) I examined the nest and found one addled egg. This was on 14th May.

The 3rd nest was destroyed by woodcutters breaking off the detached piece of bark behind which the nest was built. The remnants of the nest with a broken egg lay at the foot of the tree which led to its discovery. The site was only a foot from the ground, on a large pine tree at the edge of a foot path.

Had I known these birds built so low down I might have discovered them earlier. My experience may assist others in further observations.

I also saw a pair feeding their young very high up on a huge pine tree, so they do not always build low down, but I should think a number must, as subitale pieces of detached bark are more likely to be found low than high up on trees.

RANIKHET, U. P.
10*th August* 1922. F. FIELD.

No. XXV.—SOME NOTES ON THE METHOD EMPLOYED IN CATCHING CROCODILES IN SOUTH INDIA.

I enclose a photo taken of two Valans with a crocodile captured by them with their queer instruments which if you care to publish may be of interest to some of your readers.

These Valans and Katal Arayan are fishing castes of the Cochin and Travancore States. The name Valan is derived from Vala, meaning fish in a tank. The method employed by the two particular men who I witnessed catch this crocodile is novel and exciting to say the least of it. These Valans are, for their

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particular craft, expert rowers or perhaps I should say boatmen, and possess the special privilege of rowing from Thripunathura the boat of His Highness the Maha Raja for his installation at the Cochin Palace, when the Aravan "(or Aravar, the headman of their caste who is appointed by thitturam or writ issued by his Highness the Maha Raja)" with sword in hand, has to stand in front of him in the boat. However I am transgressing and to return to the method of capture I witnessed, I will explain it briefly as follows. Each man is provided with a long bamboo pole, at one end of which is fastened some 30′ of rope, the pole itself is generally about 5 to 6′ long, at the other end of which a 1′ iron rod is spliced at the end of which is a 3 to 4″ barb, and this weapon although not too well-balanced can be thrown with great force and accuracy up to 15 to 20′. Each individual is also provided with a "one man" tiny canoe, which can only be steadied by the paddle, or one end of the bamboo pole referred to, an axe is also carried and one then proceeds gingerly to the hunting ground, in the case of the European with as few clothes on as possible. I have to admit my boat being towed, as the difficulty for any European to balance one of these egg-shells alone and propel it for any distance without tremendous strain and considerable anxiety would no doubt be difficult for those who have not experienced it to understand, and is a feat that cannot be accomplished without considerable practice. However having arrived at our destination off the Vembanad lake in a small lagoon (the water here being slightly brackish) one of the Valans informed me there was a crocodile in the middle of the expanse of water in front of us, the water there eventually turning out to be about 6′ deep. I cannot say I had noticed or could see anything, but he told me he had seen the ripple on the surface when it sank; we proceeded carefully to the spot, 3 boats in a line about 15′ apart and one of us in each. I had the embarrassing post of honour in the centre. The man on my right eventually stopped his boat and pointing into the water on his right said in a solemn undertone, "he is down there." I am afraid I felt rather inclined to say "he is quite safe, leave him alone" especially as we had been told he was a twenty footer and swallowed cows whole! The boat on my left circled round to the other side of where he was said to be, and I was instructed to close up but assured them I felt sure I must be in the line of flight, whereupon I was left alone and felt able to breathe once more. However my respite was short, as one man kneeling in his boat gently lowered his pole into the water until only about a foot of the top was visible, then suddenly drove it down with all his might: the result was rather sudden and did not give one much time to think. A large crocodile shot up to the surface with a tremendous commotion between these two boats, one was capsized and its occupant made remarkable time for the bank holding on to his length of rope, his harpoon being firmly embedded, the other man had also driven his in as soon as the crocodile appeared and he also made tracks in his boat, for the bank which was only some 50 yards away. In the meantime the south-west monsoon appeared to have burst to my starboard and waves appeared to be running mountains high, however with my pole I managed to find bottom and there I held on as I should have been capsized in a second if I had let go. After some 5 minutes the crocodile went to earth about 15 yards from the bank, and I lost no time in getting ashore; the animal was then again stirred up and with the help of some 12 more men we got him up high and dry in about a quarter of an hour. The axe was not necessary as his brain had been pierced by one of the barbs. He was 9′ 11″ long, very fat and in fine condition. The men assured me they had often had much worse trouble.

T. H. CAMERON, F.Z.S.,
Asst. Commissioner.

White House, Peermade,
Travancore, S.I.,
10*th June* 1922.

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No. XXVI.—NOTES ON A COLLECTION OF SNAKES FROM SHEMBAGANUR, PALNI HILLS.

(Circa 6,500 feet).

I am indebted to the Revd. L. Anglade, S. H. College, Shembaganur, for the privilege of examining a small collection of snakes collected locally, some of which are specially interesting.

Family—UROPELTIDAE.

Silybura pulneyensis, Beddome.

One typical but rather shrivelled ♀. Ventrals 182 ? Subcaudals 8 ? I notice in this species the tip of the tail is invariably white, as it is in *maculata* and some others.

Silybura nigra, Beddome.

This would appear to be the commonest species in the Palni Hills. Five specimens in all were included. ♀ Ventrals 179. Subcaudals 7. ♀ 324 mm. (12¾ inches) long. Ventrals 185. Subcaudals 6 on the right side, 7 on the left. ♀ Ventrals 178. Subcaudals 7. ♀ Ventrals 178. Subcaudals 6 on the left side, 7 on the right. ♀ 237 mm. (9⅜ inches). Ventrals 176. Subcaudals 5 on the right side, 6 on the left. This proved to be gravid, and contained four eggs in the oviducts, measuring 21×8 mm. These contained small embryos about 25 mm. long (1 inch). The size of the eggs, and the condition of the embryos lead me to think that this species is ovoviparous. Unfortunately the date of capture is not on record. The tip of the tail in all is black.

Platyplectrurus madurensis, Beddome.

Four specimens of this little known species were received. ♀ 260 mm. (10¼ inches). Ventrals 171. Subcaudals 11. This contained two eggs 25×6 mm. long, with small embryos about 25 mm. long within. ♀ 311 mm. (12¼ inches). Ventrals 171. Subcaudals 12. This was captured on the 1st of April 1907, having just laid five eggs. The eggs measure 25 to 28 mm. × 10 mm., and contain small embryos about 25 mm. in length. The eyes in the embryos are conspicuous. The heart and neighbouring viscera are still extra-abdominal. ♀. Ventrals 175. Subcaudals 10. ♂ 117 mm. (4⅝ inches.) Ventrals 168 ? Subcaudals 15. This appears to be a hatchling. There is no record of the date of capture.

Family—COLUBRIDAE.

Amphiesma stolata, (Linné).

One quite typical.

Xylophis perroteti.

Two examples.

Oligodon venustus, Jerdon.

One ♀ specimen. Ventrals 161. Subcaudals 31.

Chrysopelea ornata (Shaw).

A young specimen 317 mm. (12½ inches), appears to be a hatchling. Date of capture not on record.

BANGALORE,
November 1920.

F. WALL,
Lieut-Col., I.M.S.

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No. XXVII.—GORDIUS WORMS.

Among the snakes sent to me by Father Anglade from Shembaganur is a Gordius Worm. I have now seen several of these curious nematodes, which are remarkable for the tenuity of their calibre coupled with their length, reminding one of a fiddle-string. One specimen was found in the mules' drinking trough at Drosh, Chitral (circa 4,500 feet) in April 1910, during very cold weather when snow was on the ground. I sent this to Professor A. E. Shipley who forwarded it to Professor Camerano of Turin, and it was pronounced a *Gordius zavattarii*, Camerano. Another was killed in my outhouses in Almora (5,200 feet) on the 2nd of January 1911, on a bitterly cold day when sleet was falling. It measured 495 mm. (1 foot 7½ inches), and was exactly like an animated fiddle-string. Another came to my notice in Dibrugarh, Assam, date uncertain, but it was in the winter and the weather cold. Another was found in the drinking water supply in Shillong (circa 4,800 feet) where it created considerable excitement from its extraordinary activity. This was sent to me as a snake for identification. A similar worm was noticed by me in a puddle by the road side left by recent rain, above Newara Eliya, Ceylon (circa 7,000 feet) many years ago, and astonished me by its activity. All of these appeared to me to be the same species. The specimen from Shembaganur however is very much compressed, and the body of greater calibre than in the previous specimens I have seen, and is probably another species. When forwarding the first mentioned specimen to Professor Shipley I asked for information about life habits, and obtained the following reply.

> "The Gordian Worms fertilise each other, and lay their eggs free in water. They twist about amongst plants. The egg gives rise to an embryo, which bores into some water mollusc or insect, and encysts there for a bit. This mollusc or insect is generally eaten by another insect, such as a mantis or a beetle, and the larvae grow very largely in this second host, absorbing its tissue. After a time the worms emerge free, often a large number on the same day, giving rise to the idea that there has been a shower of worms."

Considerable mystery surrounds these extraordinary worms which appear as if by magic. Some natives declare they fall with the rain, and in Chitral they firmly believe they are generated during falling snow.

It is probable that many of our members are familiar with these nematodes, and it would be interesting to collect more specimens to determine the number of Indian species, and their distribution.

BANGALORE,
November 1920.

F. WALL,
Lieut.-Col., I.M.S.

NO. XXVIII.—A PYTHON'S LONG FAST.

The following is an extract from a neighbouring planter's letter:—

"Herewith the facts about the python. I shall be interested to hear what the Bombay Natural History Society say about it, if you think it worth informing them. The python was a young one 9½ feet long. It was caught, without being injured some time in 1911 or 1912. It was kept in a wire cage for 2½ years. During that time it ate absolutely nothing. It was tried with frogs, and a pigeon was in its cage for 5 or 6 days. The pigeon had to be removed as it started bullying the python. It had a dish of water in its cage always, but there is no absolute proof that it drank. During the 2½ years it changed

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its skin regularly and appeared in perfect health. At the end of the time it suddenly began to get thin and weak very rapidly, so we let it go in the jungle." Toads and ducks were also presented. The author of the above story, Mr. F. G. Rallantyne of the Poloi T. E., who kept the reptile in captivity, Col. R. St. J. Hickman, C.I.E., and Dr. Davis of the Bura Jalinga T. E. can vouch for the above facts. I would be glad to hear from any member of a similar case of the longevity of a python's fast.

BORO JALINGA T. E., DWARBAND P.O.,
CACHAR,
17*th June* 1922.

A. G. MCARTHUR.

[We would refer members interested in this subject to Col. Wall's exhaustive treatise on the common python which appeared in Part II, Vol. XXI of this Society's Journal. "A Popular Treatise on the Common Indian Snakes". Illustrated copies of this part are obtainable from the Society—Price Rs. 10.—Eds.]

NO. XXIX.—NOTE ON THE OPERCULUM OF THE TURBAN-SHELLS.

The object forwarded by Captain T. S. Jervis is the stony operculum of one of the Turban-shells, gastropod molluscs of the family Turbinidae. Possibly it belongs to the common Indian species *Turbo argyrostoma*, abundant on rocky shores all round the coasts of India. This operculum is always plano-convex in shape and stony in structure. In life it is attached by the flattened side to the upper surface of the tail end of its owner, which is a snail-shaped mollusc allied to the pretty Top-shells (Trochidae) so common at home among rocks and boulders; the latter, however, have an operculum thin and horny and marked with a closely set spiral, very different from the thick, stony and massive one characteristic of the Turban shells. When one of these animals retires into its shell, when alarmed or attacked, the operculum serves as a door or rather stopper to close the opening and so to keep the intruder out. The Turban shell operculum is particularly effective for this purpose; it is too hard to be broken through or pierced and its rounded (convex) shape prevents a powerful enemy from getting a grip at the sides in order to tear it out.

The outer rounded surface of the operculum is usually more or less prettily mottled with green on a white ground; that of one species found in New Zealand is so very brightly ornamented with green and brown that the Maoris value it highly as a personal ornament and set it in gold, particularly in the form of brooches; they also employed specially large and fine ones to make the eyes of their weirdly fashioned wooden idols in former times. There are also species so large that the operculum is heavy enough to be used as a paper weight two inches in diameter. Such big shells are valuable as a source of mother of pearl for the manufacture of pearl buttons in particular.

In India the operculum of Turbo is one of several common objects of the sea shore that possess deep interest for the pilgrims and devotees who flock in thousands from all parts of India to worship at the most holy shrine of Rameswaram in the south. There, just within the main entrance to the temple, half a dozen shell vendors are allowed stalls; on the floor in each are arranged trim heaps of shells of many sorts, all carefully separated according to their kinds. Here is a pile of several thousand Money Cowries from the Maldives, there a smaller one of the same shells but brighter in colour and larger in size from the

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reefs of the coral islands south of Pamban Pass, close by is a heap of the pretty Eyed-Cowry, and so on through the whole series of local shells that are attractive either because of their colour or their shape. And with them are always great heaps of thousands of the stony opercula of the Turban shells. The Tamil name for these is *ambiliman*, meaning "the disc of the moon."

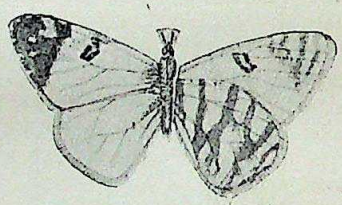
The actual shells of Turbo, after the death of the occupants, are often appropriated by hermit-crabs; some of these are more at home on the beach above tide-mark than in the sea, and, in the Laccadive Islands, on turning big boulders in the screw pine scrub along the beach a crowd of hermit-crabs usually make off in a flurry hiding their soft tails in Turban shells.

JAMES HORNELL.

MADRAS, *8th June* 1922.

NO. XXX.—SOME INTERESTING SPECIMENS OF THE PIERID GENUS *EUCHLŒ*.

(*With a text figure*)



Among a collection of butterflies sent to the Zoological Survey of India last year for identification by Mr. G. E. Shaw were several specimens of two forms of the Pierid genus *Euchlœ*, one closely related to *E. charlonia transcaspica* and the other to *E. belemia*. The form related to *transcaspica* was originally thought to be a race of the form described by Bingham as *Synchloe lucilla*, (but which is now regarded as a race of *E. charlonia*), differing only in being quite white. It is, however, more closely related to *transcaspica*, differing mainly in size, its whiteness and the paleness of the underside of the wings and the conspicuousness of the marginal white markings on the upperside of the forewings. Mr. N. D. Riley has very kindly compared one of the specimens sent to me with the twenty-four examples of *transcaspica* in the British Museum and finds that it disagrees in these points from all of them. He writes that if there are many specimens exactly like the one I sent him they should receive a name, but though I have seen many specimens I have refrained from describing them as new as I hope Mr. Riley will do so himself. The object of the present note is merely to bring to the notice of the Society's members the fact that the butterflies mentioned here are apparently new, and to ask them if they have any specimens to send them to Mr. Riley at the British Museum, who will I think be pleased to name them.

The form related to *E. belemia* differs chiefly from the *forma typica* in its smaller size and the markings on the apex of the forewings and the underside of the wings. The apical area of the upperside of the forewings is almost entirely black, except for a small white spot near the costa and two ill-defined white dots. The apical area of the underside of the forewings is marked with yellowish* green stripes, which are considerably narrower than those of the typical

* Under a lens the "yellowish-green" stripes on the underside seem to me to be really blackish, with tiny yellowish-green scales superimposed.

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form, and the stripe adjoining the termen is also much reduced and does not touch the margin. The underside of the hindwings is marked with similarly coloured stripes which are much narrower and lighter in colour than those of typical *belemia*. This form is either a new or a seasonal variety of *E. belemia*. (See figure.)

The form of *charlonia* has been taken in South Persia by Dr. C. L. Digsby-Roberts, and Mr. G. E. R. Cooper of the Survey of India has also taken it from Turbal-i-Hindari to near Robat in Baluchistan, while his brother took it at Toba in Baluchistan in May, 1910. Dr. Roberts' and Mr. Cooper's specimens were all taken from February to May, 1918 and 1919. Mr. Cooper informs me that the form was very common round hill-tops and mounds. The form of *belemia* was taken by Dr. Roberts in Guhra,* South Persia, in May, 1918. The typical form occurs in South Spain, North Africa, the Canaries, Asia Minor and Syria.

The Zoological Survey of India has two specimens of each of these forms and I believe Dr. Roberts and Mr. Cooper also possess examples of these butterflies.

CEDRIC DOVER,
F.E.S.

INDIAN MUSEUM,
CALCUTTA, *January* 1922.

We submitted the above note to Lt.-Col. H. D Peile who wrote as follows :—

"*Euchlœ transcaspica*, Stgr., seems to be the same form in Mesopotamia as in Persia; and *E. belemia*, E., is also very probably the same for both these regions.

Euchloe transcaspica, Stgr.

A male of the typical *transcaspica* (2nd generation) form, agreeing well with transcaspian specimens in the B. M., was taken by me on 11th April 1920, at Fathah, on the right bank of the Tigris on a small hill crest on the Jebel Hamrin range, at about 500 ft. elevation.

The 1*st brood* (Jan.-Feb.) has been named *vernalis* by Verity. Le Cerf records it from Danah Konh and says it is slightly intermediate.

The *Summer form* of *transcaspica*, Stgr., from N. Persia and Turkestan is more yellow than the Spring form.

Euchloe belemia, E.

In Mesopotamia this varies very much in size, and in the markings of the upper and undersides, with the season.

Capt. N. D. Riley has recently gone through a long series of this taken by me in Mesopotamia in 1919, and selected from them a series of 81 specimens which are now incorporated in the National Collection.

The *Wet season form* (Jan.-March) have the black markings above very pronounced, the bases of both wings being black; and on the underside well defined, dark green bands broader than the white bands between them.

The *Dry season form* (Mar.-Apl.) has much less black above, and on the underside narrow, broken up green and yellow streaks between wider white portions; this form being also slightly the larger.

Five specimens indicated a partial *third brood*.

Both 'wet' and 'dry' forms were taken in perfectly fresh condition in the last week of March.

This seasonal variation is referred to more fully under this species in the article on "The butterflies of Mesopotamia" in Vol. XXVIII, No. 2, of the Society's Journal.

* This locality is known to most Europeans as *Gorha*, but Dr. Roberts informs me that the correct Persian name is *Guhra*.

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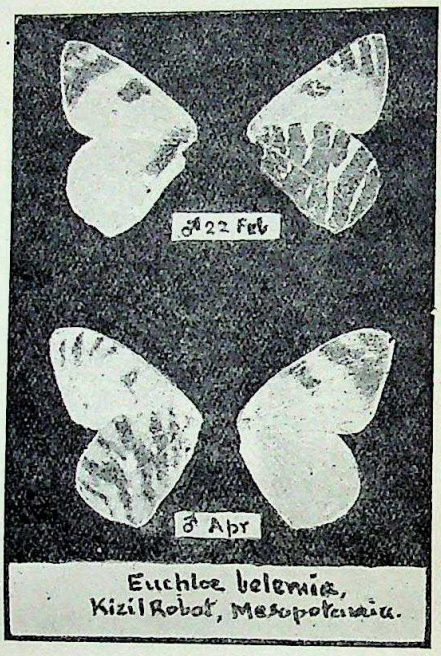

The accompanying transfer shows extreme variations in markings. The specimen sketched by Mr. C. Dover seems to be an intermediate one taken about he end of the wet season.

Coloured sketches of the larva and pupa are with my specimens in the National collection."

No. XXXI.—A NOTE ON THE OCCURRENCE OF A SPECIES OF THE FAMILY *RAPHIDIDÆ* IN BRITISH INDIA.

The family Raphididae is generally regarded as being allied to the Sialidae and with it forms the comparatively new order Megaloptera. There are two genera: *Raphidia* and *Inocellia*, easily distinguished from each other by the fact that in the former genus three ocelli are present on the head, while in the latter they are entirely absent. In his recent account of the family in *Genera Insectorum*, *Megaloptera* (1913), Dr. Esben-Petersen gives the distribution as Palaearctic and Nearctic regions, one species being also found in the Neotropical region. This is *Raphidia herbsti*, Petersen, from Chile. The family has not hitherto been recorded from the Oriental or Australian regions. While putting away a collection of insects made by myself in the jungle around Calcutta in November, 1920, I found a species of Raphididae among them, and a search through the collection of Neuropteroid insects belonging to the Zoological Survey of India revealed another, but badly damaged, specimen, labelled "Upper Burma."

Mr. T. Bainbrigge Fletcher very kindly informs me that he has specimens of the genus *Inocellia* from Shillong in the Pusa collection which he thinks might be now. These are being referred to Dr. Petersen for identification.

With the assistance of Mr. H. Srinivasa Rao, M.A., I have identified the Calcutta specimen as *Inocellia crassicornis*, Schummel (cf. Petersen, *loc. cit.* p. 11, pl. 2, fig. 3) and the Burmese example probably belongs to the same species

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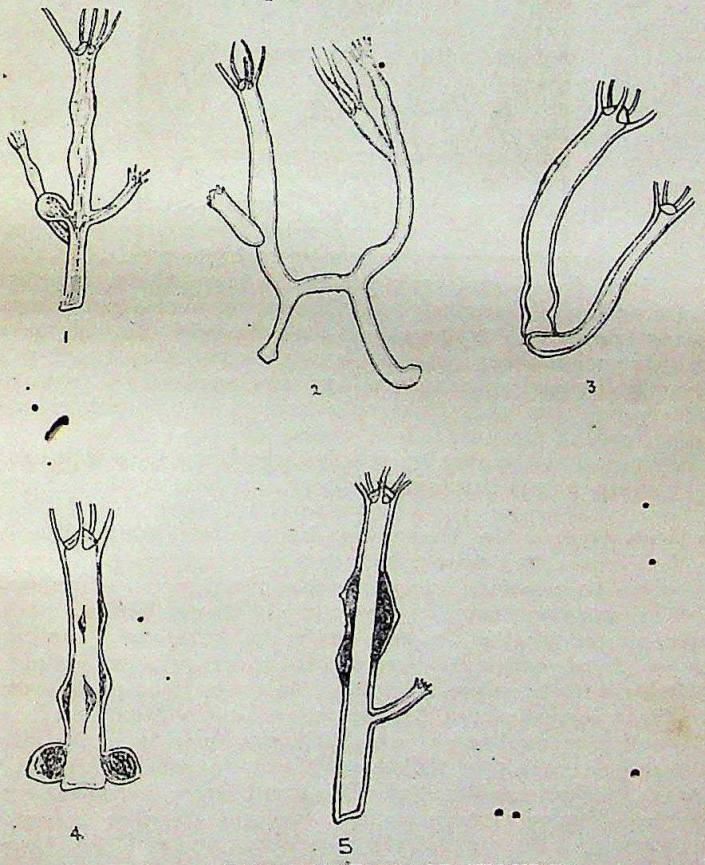
certainly to the same genus. It might be of interest to mention that in my specimen the first subcostal nervure of the right forewing is forked and so is Cu^1, while the venation of the left forewing is perfectly normal and agrees with that shown in Petersen's figure. *I. crassicornis* is apparently widely distributed and has hitherto been recorded from Sweden, Saxony, Westphalia, Silesia, Hungary, Italy, Siberia, and as close to India as Japan.

CEDRIC DOVER.

CALCUTTA,
20th January 1922.

No. XXXII.—A NOTE ON THE REPRODUCTION OF THE COMMON HYDRA OF BENGAL (*HYDRA VULGARIS*, PALLAS).

The following observations were made on *Hydra vulgaris*, Pallas, in the months of August and September, 1920. The polyps were reared in cylindrical glass jars containing weeds from a pond.



EXPLANATION OF FIGURES.

Fig. 1.—Budding Hydra with characteristic moniliform appearance.
Fig. 2.—Colony formation of Hydra by budding.
Fig. 3.—Vertical fission of Hydra.
Fig. 4.—Hydra bearing spermaries in different stages of development.
Fig. 5.—Hydra bearing spermaries and a bud.

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Fission.—An instance of vertical fission was witnessed on the 26th August, 1920. Fission was more or less complete and the two polyps were still united by the basal part of the column. One had five tentacles and the other four. The contraction and expansion of the column and tentacles of the polyps were independent. The gastro-vascular cavities were continuous and small particles were seen passing through the fluid from the gastral cavity of one into that of the other. The ectoderm and endoderm were distinct, and at the base of the polyps were observed two endodermal prominences. The ectoderm in this region was slightly depressed. (See Fig. 3.)

On the following day an endodermal wall was completely formed cutting off the gastro-vascular cavity of one polyp from that of the other. The ectodermal depression was invaginated. On the third day the ectoderm of the basal disc was formed and the polyps were sticking to each other by a secretion of mucus. The same evening they were observed to have separated. The difference in the number of tentacles of the two polyps was still maintained.

Though several polyps were reared for over two months this was the only instance of vertical fission observed.

In his account of Hydra in the *Memoirs of the Asiatic Society of Bengal*, I, p. 344, 1906, Dr. Annandale states that he has only seen three instances of vertical fission. Apparently this mode of reproduction is very rare.

Budding.—Several individuals bearing two or three buds were seen during the earlier part of August. Most of the buds were in a fairly advanced state with, as a rule, the same number of tentacles as in the parent polyp. The lower half of the column was slender and transparent, and as a result of swellings the upper half was moniliform (Fig. I). Usually the buds were confined to a small zone about the middle of the column; and it was remarkable that the column below this zone did not present a moniliform appearance. This phenomenon was noticeable in the budding individuals only. That the swellings are different from buds is suggested by the fact that they sometimes disappear and reappear in the same place. The entire gastro-vascular cavity is clear, and any food particle too large for it can at once be seen. Several individuals with the swellings were examined, and in none of them were they the result of distension by food particles or other foreign matter.

The budding polyps were generally found attached to the bottom and sides of the glass-jar, and to the underside of weeds.

The polyps attached to the sides lay usually inclined upside down with the tentacles fully expanded and hanging pendulously. A horizontal and rarely an erect position was however assumed by some individuals.

In the "Fauna" volume on Fresh-water Hydroids, Dr. Annandale states that he has never seen a bud giving rise to buds while attached to the parent hydra. I have seen an instance of this phenomenon on a single occasion (August 18, 1920). This polyp was found at the bottom of the jar. It was difficult to make out the order in which the buds had arisen. There were two fairly well developed buds, one with five tentacles, and the other with six. The former had one bud and the latter two (Fig. 2). It may be suggested that the first parent polyp underwent vertical fission for some distance down the column, when budding started precauciously on each of the daughter polyps. There was however no clear evidence to show that the colony formed as entirely due to budding or to vertical fission and budding. This branching hydra was unfortunately devoured by a dragon-fly larva a few days later, and no further observation could be made on it.

Branching in *H. oligactis* was noticed by Baini Prashad in Lahore.*

Spermaries.—From about the last week of August upto the 4th September, several polyps bore spermaries. Subsequent to this date sexual activity gra-

* See Journ., As. Soc., Bengal, (N. H. S.) XII, p. 143 (1916).

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dually slackened, and about the middle of September no polyps bearing spermaries were observed. Bud-formation recommenced, lasting for a couple of days. The polyps were very thin and transparent.

The spermaries generally arise as small mound-shaped swellings on the upper half of the column. They are however not restricted to this region, as occasionally several may be seen in the basal part of the column (Fig. 4). The number of spermaries apparently varies, sometimes seven or eight being formed close to one another. They are found in different stages of development, and do not seem to be arranged in a definite manner. In the more developed spermaries the active movements of the spermatozoa can be observed under the low power of a microscope. As they mature a fine spray of sperms in the form of a faint white cloud is ejected from time to time from the papilliform process at their apex.

Sometimes buds are also formed simultaneously with the spermaries but they are always found below the region on which spermaries arise (Fig. 5). One after another the spermaries discharge their contents, and the polyps become very thin. A few however recommence budding, but the buds remain undeveloped.

H. SRINIVASARAO, M.A.

No. XXXIII.—FOLKLORE OF BIRDS AND BEASTS OF INDIA.

I have read with much interest Mr. Fitzpatrick's article in Vol. 28, No. 2, of the Journal on folklore of birds and beasts and would like to know if he has any stories connecting the actions of birds and beasts with a forecast of the monsoon.

Sir Gilbert Walker, our chief rain-maker, may base his forecast on such things as barometrical pressure in places in South America or Zanzibar, a low or high Nile, late snowfall in the Himalayas, etc., but we who live in agricultural districts *know* that the monsoon is really foretold by the blossoming of the *nim* trees and *khed* bushes, the direction of the wind at *Holi* and the lucky and unlucky days on which lightning is seen.

I remember last year there was lightning one day early in June and I was told there would be no rain for 72 days. There was none for about 45 days which was not a bad effort to fulfil the prophecy!

But the clinching test is the position of the eggs in the nest of a 'Did he do it' (Red Wattled Lapwing). If the pointed ends all point to the centre of the nest a good monsoon is assured. This belief prevails in Cutch and Kathiawar and probably in other parts of India. Yesterday I found a 'Did he do it's' nest with three eggs in the happy position, so it is now up to the monsoon to do its bit according to rule.

E. O'BRIEN, Lt.-Colonel.

BHUJ CUTCH,
17*th May* 1922.

No. XXXIV.—A LONG NEGLECTED GROUP OF INSECTS.

The purpose of this note is to draw the attention of the numerous naturalists who have the chance of collecting in desert and semi-desert parts of India, as well as in adjacent countries (Persia, Baluchistan, Afghanistan, etc.), to a group of insects which is always neglected by collectors. The group is *Orthoptera*, *i.e.*, grasshoppers, locusts, crickets, mantids and stick-insects: all these insects are most numerous and various in dry plains, on stony hills, on sand dunes, and in dry grassy places with scattered shrubbery; many species are

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strictly attached to a certain kind of habitat and each of the above named habitats bears its special fauna. Collecting Orthoptera is, surely, not more difficult than that of beetles, though a stout butterfly-net is wanted to catch some strong flying species and to sweep the grass and shrubs; many quite interesting species (particularly of *gryllidae*, or crickets) may be taken also at night. As for preserving, the majority of Orthoptera may be perfectly well preserved in paper packets, like butterflies and moths, or simply wrapped singly in tissue paper, with the date and locality legibly inscribed on it; the packed insects must not be put into a tin box, but in a wooden or cardboard one, where they may dry quickly. Some very large species require special attention, as they are liable to mould or rot; in these the abdomen must be slightly cut open from the underside with fine scissors, and the moisture sucked out by slips of blotting paper stuck into the wound and changed several times; in a dry and hot climate there is usually no necessity to take out the viscera and to stuff the insects with cotton-wool, a procedure which is supposed to be quite necessary and which makes a collector avoid taking Orthoptera altogether. It must be remembered that, for a specialist, even a badly preserved specimen may be of great value, though of course good series of well preserved and carefully labelled specimens are more desirable. I mention long series deliberately, because it often happens that a collector does not care to take more than one or two specimens of what he considers to be a "very common" insect, while for a specialist it is always very important to study a series in order to find out the range of individual variability of the species; besides, it is very easy for a collector to confuse more than one, superficially alike, species. Of equal importance is the collection of the same species in different localities as also in different habitats.

As I have mentioned in my papers in this Journal (Vol. xxviii, No. 1, p. 71, a.o.) the orthopterous fauna of deserts of S.W. Asia is almost entirely unexplored and even some of the most common and striking species are still undescribed. This gives a guarantee that every collection, however small, will contain new or interesting species and even genera, and this should surely make collecting of Orthoptera worth the trouble, the more so as I shall be very glad to work out collections of these insects without delay, being much interested in the fauna and having worked on it specially for many years. I hope that the Bombay Society will publish the results in its Journal, so that collectors may see that their efforts are not wasted.

Further enquiries and collections may be sent to me either through the Society or direct to me at the British Museum (Natural History), London, S.W. 7.

B. P. UVAROV, F.E.S.,
Assistant Entomologist, Imperial Bureau of Entomology.

पुस्तकालय
गुरुकुल कांगड़ी विश्वविद्यालय
हरिद्वार

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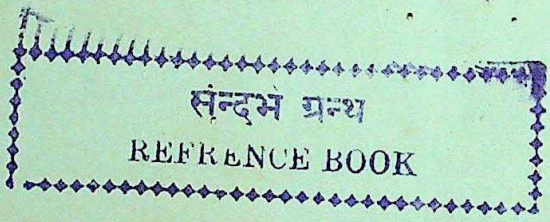

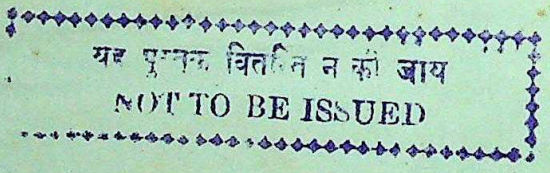

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